

University of Nebraska - Lincoln

DigitalCommons@University of Nebraska - Lincoln

Political Science Department -- Theses,
Dissertations, and Student Scholarship

Political Science, Department of

8-2014

Coercive Airpower in the Precision Age: The Effects of Precision Guided Munitions on Air Campaign Duration

Brett A. King

University of Nebraska-Lincoln

Follow this and additional works at: <http://digitalcommons.unl.edu/poliscitheses>



Part of the [International Relations Commons](#), and the [Military History Commons](#)

King, Brett A., "Coercive Airpower in the Precision Age: The Effects of Precision Guided Munitions on Air Campaign Duration" (2014). *Political Science Department -- Theses, Dissertations, and Student Scholarship*. 32.
<http://digitalcommons.unl.edu/poliscitheses/32>

This Article is brought to you for free and open access by the Political Science, Department of at DigitalCommons@University of Nebraska - Lincoln. It has been accepted for inclusion in Political Science Department -- Theses, Dissertations, and Student Scholarship by an authorized administrator of DigitalCommons@University of Nebraska - Lincoln.

COERCIVE AIRPOWER IN THE PRECISION AGE: THE EFFECTS OF PRECISION
GUIDED MUNITIONS ON AIR CAMPAIGN DURATION

by

Brett A. King

A DISSERTATION

Presented to the Faculty of

The Graduate College at the University of Nebraska

In Partial Fulfillment of Requirements

For the Degree of Doctor of Philosophy

Major: Political Science

Under the Supervision of Professor Ross A. Miller

Lincoln, Nebraska

August, 2014

COERCIVE AIRPOWER IN THE PRECISION AGE: THE EFFECTS OF PRECISION GUIDED MUNITIONS ON AIR CAMPAIGN DURATION

Brett Alan King, Ph.D.

University of Nebraska, 2014

Advisor: Ross A. Miller

Prior scholarship on the duration of coercive air campaigns has often focused on regime type, the adversary's vulnerability (of both military forces and civilian population), and the involvement of additional forces (ground/naval). Strong findings emerged that emphasized the significance of democratic attackers and the target state's vulnerability to their political and military strategies. These findings, however, do not address the role of the technological capabilities of the attacking states' air forces. A more detailed explanation of military capabilities may help to fill in this hole in the research, particularly how military capabilities affect the coercing state's ability to coerce an adversary. This paper evaluates the role of precision guided munitions in the duration of air campaigns. I find that the introduction of precision munitions increases the likelihood that a successful air campaign will terminate sooner than those that lack such technological capability.

Dedication

To Heather, Cameron and Ryan, whose patience and resolve made this possible.

Acknowledgments

First and foremost, I would like to acknowledge my committee, whose expert guidance made this dissertation possible in such a short time period; to Aaron and Jayme, and the political musings over drinks that helped refine my research and thinking; to all those friends that kept me focused and balanced through the ordeal of graduate school.

TABLE OF CONTENTS

Introduction	1
A Brief History of Precision Guided Munitions (PGM's)	4
The Political Implications of PGM's	9
Organization of the Study	12
Chapter 1: Literature and Theory	15
1.1: PGM's Effects on Opportunity	17
1.2: PGM's Effects on Willingness	19
1.3: PGM's as a Measurement of Power	28
1.4: Precision and Duration	31
Chapter 2: Research Design	37
2.1: Universe of Cases	37
2.2: Data and Operationalization	41
2.3: Circular Error Probable (CEP) Explained	43
2.4: Operationalization of the CEP	46
2.5: Model Specification	49
2.6: Case Studies	52
2.7: Conclusion	55
Chapter 3: Results and Discussion	56
3.1: Descriptive Statistics	56
3.2: Cox Survival Analysis: All Cases (1917-2003)	59
3.3: Air Campaigns: Post-1970	64
3.4: Addressing Selection Effects	66

3.5: Selection Model: All Cases (1917-2003)	70
3.6: Selection Model: Post-1970 Cases	73
3.7: Conclusion	75
Chapter 4: Operations Rolling Thunder and Linebacker I/II	77
4.1: Introduction	77
4.2: Case Study Selection	84
4.3: Technological Capabilities and Limitations	85
4.4: Strategic and Political Objectives	88
4.5: Operation Rolling Thunder (1965-1968)	92
4.6: Why Coercion Failed in Rolling Thunder	97
4.7: Operation Linebacker (1972)	100
4.8: Conclusion	106
Chapter 5: Operation Allied Force: The Air Campaign over Kosovo	111
5.1: Introduction	111
5.2: Kosovo PGM Usage in Context	114
5.3: Milosevic, History, and Holding onto Power	116
5.4: The Air Campaign: Operation Allied Force	120
5.5: Milosevic Capitulates	131
5.6: Limited Bombing Protects Milosevic	132
5.7: Widened Bombing Threatens Milosevic	134
5.8: Conclusion	137
Chapter 6: Conclusion	139
6.1: Empirical Findings	142

6.2: Case Studies	144
6.3: Future Research Directions	148
References	151

List of Tables and Graphs

Table 1: CEP to Accuracy Comparison	49
Table 3.1: Summary Statistics for All Air Campaigns (1917-2003)	57
Table 3.2: Survival Function for All Air Campaigns (1917-2003)	58
Graph 3.1: Survival Estimates per Month of Air Campaign Duration	59
Table 3.3 (Model 1): Cox Regression: Duration of Bombing Campaigns with Accuracy (1917-2003)	61
Table 3.4 (Model 2): Competing Risks Model: Bombing Campaigns with Accuracy (1917-2003)	62
Table 3.5 (Model 3): Competing Risks Model: Bombing Campaigns with Accuracy (1970-2003)	65
Table 3.6: Duration Selection: All Cases (1917-2003)	72
Table 3.7: Duration Selection: Post-1970 Cases	74

Introduction

Precision Guided Munitions (PGMs) have revolutionized warfare. This new technology enables the pinpoint accuracy of delivering a bomb with a near 100% assurance of the intended target's destruction. These weapons are capable of being directed to their respective targets in real-time following their release, similar to how a vehicle can navigate to a specific address. Initially, lasers were used by third parties to illuminate the desired target, and the munition would detect that laser and use its own control fins to adjust its flight path as it fell (much like the wings on an airplane). This internal guidance capability allowed the munition to literally fly itself to the target. With the advent of Global Positioning Satellite (GPS) technology this guidance system was moved on-board the actual munition, eliminating the need for third-party laser designators. The munitions are simply programmed with the target's latitude and longitude coordinates, and an onboard GPS receiver computes the bomb's relative position to the target and steers itself to impact. This technology provides military forces an unprecedented capability of virtually-assured-destruction of any desired target. The history of airpower doctrine has spilled much ink over the determination of what specific targets should be struck to best conclude a military victory, but the shortcomings of low precision has often negated the best doctrinal targeting studies. What good is it to properly identify the most valuable targets if the weapons were incapable at worst (or inefficient at best) of actually destroying them? PGMs have finally bridged the gap between doctrine and capability, thus opening up a potential arsenal of additional policy options available to states. These weapons opened new doors in coercive diplomacy on the world stage.

This study is first of its kind in which a measurement of “precision” is introduced to systematically test the effects of this technology on aerial campaign duration. The implications of the findings are important regardless of their statistical significance. If PGMs reduce the duration of aerial campaigns, then this capability can add significantly to the decision-maker’s arsenal of foreign intervention options, particularly in regimes reliant upon popular support for quick military victories. Lesser collateral damage can increase the support of the international community for air campaigns, coalitions may be more easily obtained, international law can be more readily complied with as standoff precisions weapons reduce undesirable hardships on innocents and they can mitigate the costs of restrictive rules of engagement. In general, the use of force can become a more attractive policy option as the risks historically associated with military force are mitigated, if not outright eliminated. In contrast, if PGMs do not affect the durations of air campaigns, then decision makers can be forewarned about the seductiveness of sterile and surgical interventions. Adversaries may be finding new tactics and strategies to mitigate the destructiveness of yet another western technology, thus refuting any notions that precision air campaigns are a low-cost panacea to resolving international disputes.

I find in this study that PGMs do in fact reduce the duration of air campaigns. A summary glance at the air campaigns since the introduction of PGMs shows a steady decline in campaign duration. The goal of an empirical assessment, however, is to determine to what affect this new technology has compared with other explanatory variables. While I build upon the existing data set and research of Pape (2007), Horowitz and Reiter (2001), and Allen (2007), this study opens up a new way of thinking about aerial campaigns, and more comprehensively, coercive diplomacy writ large. In order to

test this hypothesis I operationalized and added the measurement of precision for each air campaign (55 total) in the Pape, Horowitz and Reiter, and Allen data-set. This measure is based upon the Circular Error Probable (CEP) statistic used by the defense industry to capture the precision of weapons. Remaining consistent with the Allen methodology, I ran a Cox-regression duration analysis to test the effects of precision on conflict duration. Additionally, a selection effect had to be addressed in which I ran a Heckman selection model to determine what factors contributed to a target state selecting into an air campaign. The results reveal that there is a statistically significant effect that higher PGM levels of air campaigns do indeed result in shorter campaign durations; however, these results are cautionary in the absence of better data availability to measure the precision of non-western states' aerial arsenals and thus their effects on air campaigns. For example, the Egyptians employed PGMs in the 1973 Yom Kippur War and the Russians in the Chechnya conflict in the 1990's; however, the exact numbers of munitions employed and their realized accuracy are hard to discern.

Before one can understand the implications of this new technology on coercive diplomacy, a brief history of PGM development is necessary to better contextualize the central role airpower played in the minds of military and political leaders and to highlight the challenges posed by limited technology. Past over-reliance on air power's efficacy when dealing with foreign policy crises led to miscalculations in warfare since the 1940's, and it is necessary to understand how air power as a coercive tool evolved to fully appreciate its impact today on foreign policy.

A Brief History of Precision Guided Munitions (PGMs)

On August 12, 1944 a converted bomber aircraft was packed with 20,000 pounds of high explosives in preparation for a highly classified test (codenamed Aphrodite) of a new weapons technology (Gillespie, 2006). This new technology would allow the aircraft to be remotely piloted to a target and precisely detonated with extreme accuracy. It was hoped that this technology would help solve the unimpressive accuracy record of the Combined Bomber Offensive (CBO) being waged over Europe since 1943. World War II saw the introduction of the application of strategic airpower, and its advocates claimed in the early days of the war that airpower alone could achieve the defeat of an enemy or at least mitigate the costs of a ground war (Mitchell, 1925; Douhet, 1921). While the genesis of strategic thinking on airpower began following the introduction of aircraft during World War I, the first systematic attempt to apply these new concepts occurred during World War II. Between the wars the Air Corp Tactical School (ACTS) was established and served as the intellectual center of strategic airpower doctrine development. When General Henry “Hap” Arnold, Commander of U.S. Army Air Forces, called for an air-plan to defeat Germany he turned to former ACTS instructors to write it (Meilinger, 2000). The resulting AWPDP-1 (Air War Planning Document) dictated the manner in which both Germany and Japan would be defeated by strategic airpower. This strategy called for the bombing of the enemy’s “industrial web,” an interdependent network of industrial targets, by high-altitude, large formation, daylight precision bombing raids (Meilinger, 2000). No single target would lead to the downfall of enemy resistance, but the planners believed that destroying several key infrastructure nodes would slowly constrict Germany and Japan’s ability to fight. Thus, one saw attacks on the

Romanian oil fields at Ploesti, ball bearing plants critical for aircraft production, submarine ports, railroad infrastructure, and chemical plants essential for munitions production.

However sound the doctrine of AWPD-1, there was a fundamental shortcoming in realizing its potential: precision. A key tenet of ACTS thinking was that airpower would actually prove precise. The lessons of World War II shattered this assumption but did not invalidate the concept. Unexpected air defenses and fighter-aircraft attacks forced the bombers to remain at high-altitude for their bombing runs, thus significantly reducing the desired accuracy. Despite the best intentions of the air planners, the disappointing results of high-altitude daylight bombing led to the virtual indiscriminate area bombing of German cities. In Japan, the limitations of accuracy led to an overt campaign of nighttime, low-level firebombing of Japanese cities and industry. In addition to low precision, the allied air forces were losing aircraft and airmen at an alarming rate. From 1939-1945 the U.S. and Great Britain lost a combined total of 21,915 bomber aircraft, with approximately 55,000 airmen killed in action (Overy, 1980). The human costs of strategic aerial bombardment could not be sustained in a future war reliant upon airpower, and a solution had to be found.

The Aphrodite project in 1944 sought to remedy the extreme costs of strategic bombing by eliminating the aircrew requirement and greatly improving the precision by using a radio-controlled “flying-bomb.” Technological limitations at the time, however, required that a pilot must be on-board initially to perform the takeoff, and once the aircraft was stabilized at altitude the pilot would turn control over to a radio operator and parachute out of what now could be considered a remotely piloted drone (Gillespie,

2006). On that August day in 1944, Lieutenant Joseph P. Kennedy (son of Ambassador Kennedy and brother of the future President of the United States) took the controls of a modified B-24 bomber and launched on the third test of the Aphrodite Project. Twenty-six minutes into the flight, a faulty arming wire detonated the 20,000 pounds of explosives prematurely, enveloping the aircraft in a “large circular ball of flame and white smoke” (Searls, 1969 in Gillespie 2006), killing Joe Kennedy and his co-pilot instantly.

The Aphrodite project was abandoned before the war ended, but the technology of a precision-guided bomb was beginning the long march to realizing its theoretical strategic concepts. In the meantime, however, the technological shortcomings of precision targeting led to methods that bordered on terror tactics. In the final days of World War II, Germany unleashed a terror weapon upon the populations of United Kingdom in the form of small unmanned rocket bombs (V-1 Buzz bombs) and a new ballistic missile (the V-2 Rocket) that would indiscriminately rain terror upon unsuspecting populations (Gillespie, 2006). The hope of this new weapon was to demoralize Great Britain to the point where they would surrender. The development of nuclear weapons following World War II ushered in a new era of strategic bombing, thus perpetuating the “terror as a deterrent” aspects of the earlier German attacks on Great Britain. Following the war, Eisenhower’s “mutually assured destruction” (MAD) policy pushed the development of PGM technology to the tactical level, thus relegating precision to interdiction and ground support roles (Gillespie, 2006). After all, precision is not necessary when dropping a multiple megaton nuclear warhead on an adversary.

A significant policy shift occurred in 1960 when President Kennedy adopted “Flexible Response” as the strategic posture of the United States and its allies (Gillespie, 2006). While nuclear deterrence was essential to maintaining non-belligerence with the Soviet Union, the U.S. needed the flexibility to intervene conventionally to protect national interests abroad. Thus, U.S. military forces needed to be flexible enough to either wage an all-out nuclear war or a smaller, limited war using conventional explosives and tactics. This shift acted to jump-start PGM development efforts in the 1960’s, and subsequently accelerate them to frontline employment in the context of experiences during the Vietnam War (Gillespie, 2006).

A watershed moment for PGMs occurred during the Vietnam War when on 13 May, 1972 twelve aircraft armed with Laser Guided Bombs (LGBs) sent the Than Hoa railroad/highway bridge to the bottom of the Song Ma River (Corum, et al, 1978). What made this event so spectacular was that these twelve aircraft were able to accomplish in one mission what had frustrated air planners for the previous seven years. Thousands of sorties had been flown (with great losses) against this critical target since 1965, but the poor accuracy of the “dumb” bombs used only managed to bend, twist and char the structure (Gillespie, 2006). The air forces never succeeded in destroying the bridge as North Vietnamese workers were able to rapidly repair the superficial damage. For the first time, U.S. air forces had achieved the pinpoint precision necessary to specifically strike the abutments and supports of a bridge from high altitude, thus ensuring its collapse and total destruction. These experiences altered the way air planners viewed the importance of PGMs, and the lessons learned from this new weapon would be cemented in air doctrine at the outbreak of the Gulf War in 1991.

Those that remember the Gulf War of 1991 likely remember the stunning camera footage of cruise missiles streaking down Bagdad streets and turning corners to strike targets, or the pinpoint accuracy of bombs being dropped, not just on tanks and troop positions, but down ventilation shafts of specific structures. It was a hyper-war air campaign that lasted 37 days, and one that would not have been possible without the development of PGM technology mated with the lessons learned from the Vietnam War. Despite the dramatic effects of the live broadcasting of a war, it is not as well known that only 8% of all aerial munitions dropped were PGMs (Gillespie, 2006). Additionally, the LGBs used during the Gulf War were merely upgraded versions of the same weapons employed in the 1972 air campaign in Vietnam (Gillespie, 2006). The technology was not all that new, but what the Gulf War accomplished was to highlight a military capability in a way that forever altered the perceptions of the public and policy makers regarding the greater effectiveness and lower risks of waging an air campaign. It seemed in 1991 that the technology had finally caught up with the doctrine.

A mere four years later, NATO would find itself involved in the Balkans where in 1995 and 1999 air campaigns were waged against Serbian nationalists who were ethnically targeting portions of their population. By 1999, Operation ALLIED FORCE over Kosovo saw the usage of PGMs increase to 35% of all aerial munitions employed (Gillespie, 2006); in addition, laser-guided munitions were being supplemented with bombs that relied upon global positioning satellite (GPS) data and tracking. It then became possible for one aircraft to drop multiple bombs simultaneously, each pre-programmed with specific GPS coordinates, and assuring the destruction of a series of targets that otherwise would require multiple aircraft sorties. The unique aspect of the

Kosovo air war was that the campaign forced Serbian President Slobodan Milosevic to capitulate without deploying any NATO ground forces. These two campaigns fundamentally altered the calculations of national leaders and the general public in decisions of whether or not to engage militarily around the world.

Precision became the given, and focus shifted back to the identification of the critical targets needed to ensure victory. Arising out of this new capability, one saw a renewed emphasis on identifying the proper targets that would bring about a quick victory; social scientists began to evaluate different strategies (punishment, denial, risk, escalation, military/political vulnerabilities, etc.). International organizations and domestic constituencies began to focus on the collateral damage that often accompanied aerial warfare. Western air forces shifted to extended deterrence using global strike capabilities that minimized the need for forward basing and diplomatic maneuvering that secured those bases. These changes in strategic power dominance could not have occurred without the development of highly precise aerial weapons. This new capability revolutionized not just military operations but strategic policy thinking regarding new opportunities to advance national interests.

The Political Implications of PGMs

Scholars mostly examine PGM technology within military tactical and strategic studies; however the effects of this technology have implications in political science as well. While military studies evaluate the effectiveness of advances in technology, specifically regarding the ability to attack targets successfully at the lowest possible

costs, these technological capabilities also factor into the specific political objectives and strategies developed to attain foreign policy outcomes. In democracies particularly, foreign policy objectives are determined by political actors seeking to attain a desired political outcome while assuaging the risk concerns of constituencies they are beholden to. If the soldier's definition of 'victory' is the destruction of the adversary's will and capabilities to fight (via any means necessary), the political leader's definition must include the factors that garner the greatest support of the public and the international community at large. If the military leader is beholden to a civilian-controlled military, then the politicians concerns become the military's concerns.

Carl von Clausewitz famously stated that "War is a continuation of politics by other means" (1832, in Paret, 1976). Costs must be weighed in the political calculations of civilian decision makers when deciding whether and how to intervene globally with armed forces. In short, it is no longer sufficient to merely determine the best means to destroy an adversary's military capabilities, but it is increasingly important to weigh 'how' the military campaign is conducted in light of emerging ethical and moral standards held by domestic constituencies and the international community. These standards matter to allies and *their* constituencies, international legal bodies, human rights organizations and even the constituencies of the target state. The Vietnam War highlighted these political limitations as military and political leaders constantly struggled with each other over the best means to wage the war while an ever increasingly hostile domestic and international community was inundated with the images of the horrors of war. The increasingly integrated international system requires coalitions of allies in order to wage military campaigns, and these coalitions are more vulnerable to the

negative optics of armed conflict. The aggressor state must weigh the unintended consequences that may result from sound military strategy

In addition to the empirical analysis, it is necessary to evaluate a few case studies that could potentially highlight specific circumstances that affect the durations of precise air campaigns. Every war is different, each with a different set of actors, capabilities, goals, and strategies. It would be unwise to generalize too much regarding the empirical findings. While precision provides the ability to destroy a given target, it does not dictate what targets should be attacked, the political climate in which a war is fought, or the foreign policy goals of the attacking state. In Vietnam, for example, PGMs were not prevalent in the 1965-1968 air campaign; it was not until 1972 that their employment seemed to turn the tide of negotiations with North Vietnam. There is one distinct difference in these two campaigns in that the first was an irregular guerilla war and the second a conventional war. A Vietnam case study on these two air campaigns can shed light on the importance and effectiveness of PGMs in a specific context.

A second case study will be conducted on the Kosovo air campaign in 1999. This campaign is different from the previous two in that PGM usage tripled since the Gulf War, no ground troops were ever employed, and technology had increased to include GPS guidance systems in the weapons themselves; but despite the heavy bombing of Serbia and ultimate NATO success, many scholars and military strategists do not believe that the air war was all that decisive. After the attacks began, Milosevic stepped up the ethnic massacres and there is little consensus that the aerial bombing actually coerced the Serb leader to surrender. Political factors, both domestically and internationally may have been more decisive. Despite these assessments, the campaign was one of the shortest (78

days) in history (but interestingly the longest since the advent of PGMs), and coupled with the fact that no ground troops were used, makes this case especially interesting to study the effects of PGMs.

Organization of the Study

Chapter 1 evaluates the existing literature on coercive air campaigns and integrates the literature with a theory of precision on campaign duration. PGM employment reduces the costs typical of military conflict (e.g., friendly casualties, collateral damage), thus allowing the aerial campaigns to be waged more aggressively. I theorize that the intensity enabled by these weapons facilitates the rapid achievement of military/political objectives, thus resulting in shorter air campaign duration.

The literature on PGM technology varies with academic disciplines. Military scholars have been primarily concerned with the advances in technology and their effects on successfully identifying critical “centers of gravity” for attack. PGM’s are merely tools used to achieve a desired military objective. PGM advances have revolutionized the way in which early air power theories have been realized, and the military literature focusses primarily on PGM employment, both tactically and strategically. Political science scholars have been concerned with the outcomes of campaigns, but their focus has been the political factors that facilitate outcomes in war. The literature regarding the employment of precision aerial bombing campaigns can be broken down into three general themes: 1) Increased opportunities and willingness to use force, 2) a more nuanced approach to measurements of power, and 3) the direct effects of precision on

conflict duration. The literature review will synthesize the military historian and the political scientist to position PGMs as not just an effective weapon, but a politically coercive instrument as well.

The theory is articulated within the context of these three themes in the extant literature behind the study. The greater effectiveness of PGMs, and the reduction of costs typically associated with warfare, alters the strategic calculations of foreign policy decision makers when faced with an international conflict. In short, PGM capabilities increase the opportunities decision makers have to use to force in any given dispute. Subsequently, the increased opportunities logically lead to an increased willingness to use force as the costs of doing so decrease. Leaders beholden to constituencies may find themselves less constrained by the costs of ground troops, non-combatant collateral damage, and casualties typical of warfare. Secondly, if PGMs increase opportunities and willingness to use force, they can be viewed as a more nuanced measure of state power. A state that possesses such weapons can be more powerful and influential on the world stage without the costs of maintaining large field armies and navies that have been traditionally necessary to project power and protect national interests. The percentage of GDP spent on defense or the sizes of armies, navies and air forces may be an obsolete measure of state power. Finally, if PGMs increase a state's power relative to its potential enemies, then the realization of such power should be evident in the shortened duration of conflicts in which it is wielded.

Chapter 2 will address the research design of this study, and explain the methods and controls used in the analysis. Maintaining consistency with the most relevant literature, I employ a Cox-duration analysis to measure the effects of precision on air

campaign duration. In addition to the empirical analysis, I use a multi-methods approach by evaluating two case studies: The Vietnam War (1965-1972) and the Kosovo air campaign (1999). Both of these campaigns have distinctly unique characteristics that make them instrumental in evaluating the generalizability of the empirical findings. Chapter 3 will present the empirical findings, and chapters 4-5 will then subsequently provide the case studies mentioned above.

The conclusion will sum up the empirical findings, highlight the relevant characteristics of the case studies, draw broader implications for foreign policy decision making, and chart a path for future research development. Coercive diplomacy will remain an essential element of protecting and advancing any state's national security interests, and while advances in technology widen the array of forceful intervention options it is important to note the effectiveness as well as limitations of armed conflict regardless of the tools available for waging it.

Chapter 1

Literature and Theory

The purpose of this study is to determine the relationship between PGMs and conflict duration; however, there is scant literature on the subject. One body of literature addresses the decision making processes of state leaders, particularly weighing the costs and benefits of initiating military action. Another body of literature addresses air power as a coercive instrument; specifically, studies on the factors that enable air strikes to be successful, the role escalation plays in coercion, and the overall balance of power between rival states has produced a wide array of results. There is a more general treatment of technology as a factor in measuring a state's power; the sizes of militaries, GDP expenditures, and overall quality of armed forces play a role in a state's ability to issue a credible threat and succeed in waging war. Finally, there has been one study that measures the factors that affect air campaign duration, but it lacks a specific measure of air power precision. Each of these bodies of literature will be addressed in turn, but within the context of coercive air power and the level of precision that each state possesses.

PGMs can directly relate to a state's decision to employ military force by affecting both the state's "opportunity" and "willingness" to engage in conflict (Most and Starr 1989; Fordham 2004). Opportunity is simply a favorable time or set of circumstances for doing something. Thus, it is logical to assume that any state faced with a diplomatic disagreement with another state would take advantage of circumstances favorable to a resolution of that disagreement. Opportunities in international diplomacy can come in

many forms; decision makers can take advantage of a challenger state's change in leadership, economic hardship, international pressure, diplomatic capital where reciprocation is expected for earlier concessions, or the credible threat of superior military capability. Once a coercing state sees an opportunity to act against a challenger, there has to be a willingness to do so. Willingness is simply being ready, eager, or prepared to do something. From a national decision maker's viewpoint, willingness is tied to the political, economic or material costs of acting. An example will illustrate the theory that PGMs can increase the opportunities and subsequently the willingness to employ military force against an adversary.

The U.S. may have had an opportunity to alter the strategic dynamics of the Middle East by aggressive action against the Syrian regime following a chemical weapons attack on its own people. The international community was aghast at the attacks committed by Syrian President Assad, and there may have been a fleeting opportunity to engage militarily against the regime to signal that chemical weapons usage will not go unpunished. U.S. leadership, however, is beholden to a constituency of voters, and this constituency was not eager to engage in aggressive actions against Syria. The costs of sending in ground troops to secure the weapons stockpiles would have come with a heavy price of casualties and the thorny issue of rebuilding Syria following Assad's removal. Furthermore, over a decade of conflict in Afghanistan and Iraq highlighted the difficulties of conducting such operations, yet the scope of chemical weapons usage demanded that the west act boldly to signal that such usage was not acceptable. Thus, one sees the U.S. President threaten a military strike, not with ground forces, but with cruise missiles and potential drone strikes. The opportunity (circumstances) was present in the heinous acts

committed by the Assad regime justifying an aggressive response. The willingness, however, was tempered by the costs anticipated of a ground war and/or state-building mission. The U.S. president decided initially on an exercise of airpower, but why? The answer lies in the capabilities provided by a very precise air arsenal. Targets within the regime could be attacked with precision, assuring their destruction. These attacks could be conducted in a manner that would minimize, if not eliminate, civilian and friendly casualties, thus mitigating the unnecessary bloodshed of innocents. In the end, U.S. military action was abandoned due to the concerns that attacks would not appreciably alter the regime's ability to launch future chemical attacks, but the lesson was clear: precision air capability provides a quick opportunity to exercise diplomatic action. Had this capability not existed, and decisions makers were forced to rely on traditional ground forces or inaccurate bombing campaigns, the decision to use force would have weighed heavier on leaderships' minds. The costs in material and human lives would logically require even more sobriety in the decisions to employ military force. PGMs factor into this calculus of realizing opportunities to act and increasing the willingness to engage militarily. It is necessary to separate each to show the effects PGMs have on this decision cycle.

1.1 PGMs Effects on Opportunity

The state wielding such weapons possesses a wider range of options to coerce a target state. More options increase the state's opportunities to act against the target state. First, the high precision of PGMs requires smaller numbers of aircraft to guarantee the

destruction of desired targets. Since one bomb is virtually guaranteed to destroy the desired target, only one aircraft is necessary to ensure success. Conversely, the less precise the weapon, the greater the number of weapons are required to ensure the target's destruction. The first "dumb" bomb may miss, thus a second (a third, a fourth, etc.) is required to increase the probability of a hit. Much like a shotgun blast, a barrage of imprecise weapons is required to ensure at least one strikes the desired target. The more munitions that are required drive an increase in the number of aircraft necessary to deliver them to the targets. The greater numbers of aircraft drive a larger logistical footprint required to support them, thus raising the premium on diplomatic cooperation from third party states for basing rights and logistics support. Large squadrons of dozens of aircraft operating out of a third party state are highly visible to the host-nation population. Particularly in the Middle East, host-nation publics are not often supportive of U.S. military actions against its neighbors. The overt basing of large numbers of bomber aircraft raises domestic political concerns for the host regime. In the buildup prior to the Iraq invasion in 2003, Saudi Arabia (a traditional U.S. ally) disallowed the use of its bases for combat aircraft; only non-lethal support aircraft were allowed access to its territory. Despite this setback, PGMs provided the U.S. a larger set of opportunities by reducing the overt presence of massed aircraft and dispersing them across multiple countries in discrete numbers.

In addition to increased opportunities to disperse smaller numbers of aircraft, long range delivery options (intercontinental bombers and aerial refueling) reduce the need for basing combat aircraft in foreign territory, reducing the diplomatic maneuvering or concessions required to launch and sustain a campaign. As another example, on the eve

of the 2003 Iraq invasion, Turkey refused to allow the allies to use their airspace and bases. Despite this potential “show-stopper” the allied forces were able to divert air assets around Turkish airspace using air refueling and further afield bases to launch the campaign on-time. The allies were able to achieve this kind of flexibility due to smaller numbers of aircraft required to wage the air campaign. In the early days of airpower, massive formations of bombers were too large and unwieldy to capitalize on this kind of flexibility. The advent of PGMs and the reduction in combat aircraft required therefore expand policy-makers’ opportunities to apply force.

1.2 PGMs Effects on Willingness

These capabilities not only increase the opportunities of states to employ military force, but they may also increase *willingness* to use force. PGMs can lead to the increased propensity of a state to wage military campaigns via air power alone. Specifically, such weapons facilitate greater military effectiveness, decrease collateral damage, and increase the survivability of attacking forces (Cohen, 2004). From a decision maker’s perspective, these results can logically lead to the increased willingness to use force, as the costs associated with employing military force decrease. Precision weapons, additionally, provide the increased opportunities as the traditional limitations and challenges of military campaigns are mitigated. These challenges have included the effectiveness of aircraft to destroy their targets, the ability for the aircraft to survive the journey to and from the targets, the survivability of the aircrews themselves, the financial costs of

protracted inefficient campaigns, and the negative public perceptions of civilian casualties in the target state.

First and foremost a state needs the opportunity to apply force before it can willingly use it as a policy option. States with the economic base to fund the research and development of advanced precision weapons will therefore have the capability to employ them in order to achieve the benefits noted above. This capability would logically translate into the willingness to use it, or as Madeline Albright once quipped to General Colin Powell, “Why do we have an Army if we’re not willing to use it?” Much of the literature on the “opportunity” aspect focuses on arms races, technologically-advanced militaries, and the predatory nature of states with a military advantage. These concepts, however, do not operate independently of one another; capability (PGMs) leads to opportunity (flexible campaign options) which thus influences willingness (via reduced costs). “The conjecture that abundant military capabilities increase decision makers' propensity to use military force implies the stronger claim that capabilities influence not just opportunity but also willingness” (Fordham 2004, p.634). This line of reasoning links “opportunity” with “willingness” in the heuristic of expected utility; as the opportunities (military technology) increase, the willingness to use this advantage over an adversary also increases. “As the perceived probability of success in war increases, the utility for success can decrease and still satisfy the critical threshold of expectation at which one is willing to commit troops to combat” (Bueno de Mesquita 1989, p.147 in Fordham, 2004). In other words, with higher probabilities of success, even reductions in expected payoffs could still provide enough motivation to wage an air campaign due to the lower costs of executing the campaign.

Willingness can be influential in the decision making process especially if there is a perceived high chance of success, and PGMs can increase the decision-makers perceptions of success. If opportunity is driven by capability in expected utility models, then it is logical to posit that the probability of success increases the willingness to use force. After all, it should be easier to justify destruction and casualties to a state's constituents if the conflict is won rather than lost. For example, Lyndon Johnson's use of airpower against the North Vietnamese resulted from his belief that the U.S. military superiority would force the adversary to give up its goals (Craig, 1995). When the probability of success dropped in 1967, it became much more difficult for Johnson to convince the public that the war was worth the costs. When Nixon took office in 1972, advances in PGM technology had increased to the point that these new weapons were readily available for air operations. The chances for success increased with this new capability, which translated into a much more aggressive, effective, and shorter air campaign in 1972. While some scholars quite correctly argued that the 1972 success was due to the North Vietnamese shifting strategy (Clodfelter, 1989), or that the North fell in 1972 due to increased military vulnerabilities (Pape, 1996; Horowitz and Reiter, 2001), there is an appreciable effect of PGMs on the ability to destroy those vulnerabilities as the costs of success dropped.

In addition to military capability, other researchers link the willingness to engage in military action with domestic processes. "Military capabilities may strengthen the hand of 'hard-liners' who are more willing to use military force" (Fordham 2004, p.635). Given that the use of PGMs reduces both the human and material costs of war it is easier to advocate the use of military force to potentially reluctant constituents. Additionally,

wars can provide career advancement for policy-elites and/or military commanders if their successful prosecution of war leads to a solution to the foreign policy problem (Vasquez, 1993). Additionally, success could be used to justify increased defense budgets of the service branch that contributed most to the conflict. Betts (1977) makes the argument that civilians are more likely to initiate military conflict than military leaders, and Gelpi and Feaver (2002) supported these findings concerning the participation of veterans in the decision-making process. They found that civilian politicians are more likely to employ military force than politicians who are veterans (Gelpi and Feaver, 2002). They also predicted that as the number of veterans increased in the Congress, the less likely military force would be used; but if it was used, the campaign would be pursued much more aggressively (Gelpi and Feaver). In light of these findings, the use of PGMs could enable decision-makers to act in a manner consistent with the literature. Civilian leaders may be more likely to initiate military conflict due to their perceptions of the efficiency and effectiveness of precision technology. While veterans may have a better grasp of the human toll of combat (the fact that the bomb was surgically applied doesn't reduce the pain upon those whom which the surgery was performed), PGM technology allows the campaign to be waged aggressively to overwhelm the enemy in a short period of time thus reducing the cost of prolonged combat.

Domestic processes are driven by winning coalitions, whether in democracies or non-democracies. Coupling the military capabilities of a state with the domestic processes that perceive a quick and bloodless victory, a state may be more willing to employ coercive airpower. Political leaders (namely the U.S. executive) are capitalizing on the advancement of precision weaponry to the point that America's wars can be waged

with impunity (Ignatieff 2000). This creates what Ignatieff calls “virtual consent,” where domestic political processes (the Congress) are being bypassed as the executive appeals directly to the people (Ignatieff 2000, p.177). If the executive goes too far in advocating military intervention, public opinion will check action, not the legislative institutions whose responsibility it is. Thus, military capability is forever wed to domestic politics in regards to the U.S. executive’s decision whether or not to employ military forces; however, the technological advances in precision weaponry could disassociate the public from the real costs of war (destruction, casualties). PGMs seem to offer a low-cost option that allows democracies to wage war more often, if the risks are low enough. “Airpower is an unusually seductive form of military strength, in part because, like modern courtship, it appears to offer gratification without commitment” (Cohen 1994, p.109). Again, lower costs of war translate into an increased willingness to use it; the seductiveness of airpower (and its precision capability) could act to make war a remote phenomenon to constituencies. This remoteness could lead to an increase in the use of armed force. “Democracies will remain peace loving only so long as the risks of war remain real to their citizens. If war becomes virtual—and without risk—democratic electorates may be more willing to fight especially if the cause is justified in the language of human rights and even democracy itself” (Ignatieff, 2000 p.179-180).

The visibility of war to constituent publics has steadily increased since television brought the brutality of conflict into family living rooms. War correspondents in Vietnam, for example, were able to record the siege at Khesahn, the Tet Offensive, and the summary execution of a young Vietnamese boy by Saigon’s chief of Police. The self-immolations of Buddhist monks, the decapitations of prisoners, and the aftermath of

collateral damage can work to undermine the credibility of a “moral” military policy. In his assessment of increasingly “precise” munitions, Michael Ignatieff describes the change in popular expectations: “Once accuracy of this sort is attainable, it becomes the basis of expectation in the future. Future war may have to be pinhole surgery for it to be waged at all, at least by the United States” (2000, p. 20). In summary, if the costs are low (domestic and military) and the capability high, one may see the employment of coercive airpower increase. At first glance, Ignatieff’s observations may be bearing true, as the use of PGMs has increased since his writing in 2000. Aerial conflict has not just seen an increase in the percentage of PGMs used in the total tonnage of bombs dropped, but also an increase in the usage of pilotless drones in Libya and the greater Middle East. The greater capability of PGMs could very well increase the expectations of the coercer’s constituents that aerial campaigns will be short, decisive, and relatively bloodless.

The role of domestic processes in decision making should not be underestimated, especially as wars become less conventional and more focused on limited objectives. Some scholars found that presidential war-decisions relied more on domestic factors than the international environment and that domestic political factors are *the most* important in decisions to use force *short of war* (Ostrom and Job 1986; James and O’Neal 1991). The United States enjoys overwhelming military superiority to the rest of the world, and it is unlikely that major inter-state wars will break out within this new environment. More likely, the United States will find itself involved not just in limited counter-insurgencies, but it will be called on to engage in human rights violations in failed or failing states. Military dominance has pushed conventional warfare to the remote corners of potential decisions that the United States will likely never have to make them. Fearon (1994)

argued that the stronger state is not predisposed to success in a crisis; because *only relatively resolved states will choose to confront it*. In other words, if American military might remains far superior to the nearest competitor, a straight-up conventional fight is far more remote. Consequently, American adversaries choose asymmetric and irregular warfare to negate the United States' conventional advantages. PGMs provide a combat capability in these limited war situations. While it may not be politically expedient to conduct a large-scale conventional war against a security threat (terrorists), PGM technology allows surgical strikes against discrete targets at relatively low costs. As discussed above, if the costs of such aerial attacks are perceived by the constituency as low enough, the likelihood that decision-makers can employ such power can increase. Therefore, the effects of PGMs on decision-making are not just limited to conventional warfare. This technology allows greater opportunities (created by constituent support for the aggression) to use force in almost any situation short of conventional warfare, and this aspect will be explored next.

The majority of the literature referenced thus far typically addresses the use of force in the context of conventional 'wars,' mostly amongst states. It fails to separate inter-state wars with more limited interventions with limited objectives. Fordham makes the observation, "The logic suggesting that military capabilities influence the willingness to use force applies with equal force to instances of coercive diplomacy where war is not likely" (Fordham 2004, p.635). To take a modern example, the war conducted in Iraq in 2003 represents the more traditional conflict of one state against another, with a grand final objective (regime change), and employing large military units in a combined offensive against similar (if inferior quality) military hardware. Contrast the Iraq war

with the very limited size and scope of the Libyan intervention in 2011. The latter intervention was carried out largely in the name of humanitarianism, and the means employed consisted of pilotless drones, reconnaissance, and aid to indigenous rebels. Full scale wars have a much broader impact and carry with them greater consequences that “...may trump the immediate availability of military capabilities (Fordham 2004, p.635).” To illustrate, the United States may have the military capability to intervene in Syria’s civil war, but the greater ramifications of such an intervention (effect on the Middle East) may outweigh the decision to employ forces. Criticisms of using force in Syria focused on the possibility of getting embroiled in another Middle Eastern Civil War, and the high cost in lives and material that would follow. This lower willingness to engage in combat operations was partly mitigated by the decision to conduct limited strikes using highly precise cruise missiles. While even this option failed to gain constituency support, it seems to support Fordham's conclusion that “small-scale uses of force have lower expected costs” (Fordham 2004, p.635), which would translate into a greater willingness to use force. PGMs provide a capability where foreign policy objectives can be met short of full-scale war that was unavailable to decision makers before their development. Thus, the opportunities to employ force are increased simultaneously with the willingness to engage in a “reduced-costs” political environment.

Domestic conditions and military capabilities work hand-in-hand and cannot be easily separated. PGM technology works to mitigate the tensions between these two factors. PGM technology offers a new dimension to the concept of measuring state power. It is no longer sufficient to measure a state's power merely in the number of troops it possesses, the number of aircraft it maintains, or the number of ships it sails. The

lethality of war is no longer measured in materiel but in its effective employment. PGMs use Global Positioning Satellites (GPS) to give the military commander capabilities unheard of in historic warfare. In 1942, it took 100 bombs just to get one of them to fall within 100 feet of the intended target. The missions required hundreds of bombers to attack one target to achieve the desired success; losing up to 60% of the bomber force on some missions to enemy action. By contrast, one stealth bomber (or cruise missile) can use one bomb to hit within 10 feet of the desired target, with virtually no risk to the pilot; and if the risk to the pilot is too great for a given target, a pilotless drone can achieve the same result. Measuring modern US power relative to its power during World War II is more than merely counting the number of aircraft used or tonnage of bombs dropped. A measurement akin to "lethality per unit" seems more appropriate in a technologically advanced age. Capability is not measured in military budgets or numbers of aircraft, but in the unique ability to achieve the mission objective with almost zero chance of failure.

As per the theoretical discussion thus far, PGM technology can be seen as a way to increase the willingness of states to employ military force, resulting from the increased opportunities to achieve foreign policy objectives short of full-scale conventional warfare. If political support via constituencies is an important factor in the willingness to use force, and if the capabilities of the military are sufficient to enable a state to attack targets that were previously unreachable at acceptable costs, then this technology could be viewed as adding an additional "arrow" of power to the "quiver" of a state. PGMs offer a new way to assess the power of a state. This aspect will be addressed in the next section with PGMs as a measurement of power.

1.3 PGMs as a Measurement of Power

The concept of power plays a significant role in international relations and figures prominently in estimates of the ability of a state to exercise control over other states. From a realist perspective, power is defined as the ability to move others by threat or inflicting harm (Wolfers, 1962). A state's interests are defined by their efforts to maximize power, and this power is key to understanding international policies (Morgenthau, 1948). In this sense, measuring power has become a function of counting the military resources available to any given state. Mearsheimer (2003) measures power by the aggregate assets and material resources available to a state; such as GNP, steel production, and energy consumption. This measure is adequate to gauge the latent capability for a state to mobilize for a large conventional military conflict; however, with the shift away from conventional war towards more irregular and asymmetric conflicts, this measure begins to fall short. It is unlikely that a state will mobilize its entire economy to fight a limited conflict to alter the behavior of a minor state. As a reaction to this changing environment, other scholars have attempted to view power less in terms of military capability and more in terms of indirect and influential power. Complex interdependence links states together economically and politically, and under such conditions, economic and political means can be used to coerce or influence other states without the need to resort to military force (Keohane and Nye, 2001). This "soft power" can lead to policy objectives through cooption rather than coercion (Nye, 2002). In the constructivist vein, power thus becomes less reliant on material capabilities and more a function of how actors "perceive" power (Wendt, 1999).

The advent of PGMs has the ability to integrate all of these measures when power is viewed as the distribution of capabilities across states (Waltz, 1979). Military capabilities are more than merely measuring defense budgets and physical sizes of armies, navies, and air forces. Capabilities are more accurately measured by the state's ability to bring the requisite amount of coercion (or its threat a la Schelling, 1966), to bear on the target state. Additionally, if the target state lacks the same capability as the coercer, it loses the capacity to counter-escalate (Byman, Waxman, and Larson, 1999). This disparity in capabilities distribution is based on the quality of military material, not the quantity. PGMs provide a more nuanced approach of measuring this distribution of power across states by allowing all three modes of power to coexist. First, the material capabilities must be present (PGMs, the aircraft to deliver them, and the training of operators). Secondly, political power can be wielded as the threat of employing such weapons threatens the target regime in such a way to derive concessions (Serbian President Milosevic conceded to inspectors initially under the threat that airstrikes would weaken his political base (Hosmer, 2001)). Finally, the lethality of relatively few aircraft and the greater support of domestic constituencies reduce the perceived costs of an aerial campaign; thus increasing the credibility of the threat against the target state. Power as a "perception" becomes more salient.

PGMs appear to be a significant factor in realizing this aggregated power structure. They provide material capability, increase the willingness for states to employ it, and garner the support of states' political bases; thus augmenting the perceived power of the coercer. Capabilities are not just the volume of war-materiel but the effectiveness, lethality, availability, and the credibility of employing them. Such capabilities can shape

the decision-making process. If capability leads to willingness, and willingness is wedded to domestic processes, then the decision to employ force must be effective in attaining a state's goals in order to be justified and supported. Effectiveness becomes the lynch pin around which the decision making process pivots. Quality, not quantity, is the key factor in determining whether or not to employ forces. Are these campaigns effective? Does the use of PGMs shorten the duration of the conflict, bring about peace faster, and succeed in coercing an adversary? If the answers to these questions are in the affirmative, then a case can be made that the power of the coercing state is embedded in its capabilities to achieve its policy objectives, not so much in the quantity of war-making assets at hand. Quality trumps quantity, and this efficiency/effectiveness is a necessary precondition for considering the propensity to use force. There must be a perceived chance of success at relatively low cost before decision makers commit to military action, and if this logic holds true then an appropriate way to measure the outcome is in conflict duration. As air campaigns become precise, then the conflict duration should decrease as objectives are attained quickly and at lower costs.

Before concluding this section on the elements of power PGM's bring to this study, it is necessary to clarify an assumption regarding regime type and technological capabilities. I make an assumption that democracies are more likely to possess the technological advances that enable the development and employment of PGM's. Ideally, an empirical test should be conducted to support this assumption, however, time and data availability preclude such a rigorous attempt. This study concurs with the predominant research on military capabilities and regime type. Reiter and Stam (1998a) find that democracies tend to win wars through better logistics, leadership and initiative.

Democracies are also more militarily effective due to superior human capital, harmonious civil-military relations, and western culture (Biddle and Long, 2004). Others find that information technology advantages facilitate military effectiveness (Nye, 1996). Specific to military capabilities, Paarlberg (2004) finds that the quality, not quantity, leads to military primacy. Higher quality weapons are typically more expensive to develop and operate, logically requiring more robust economies to support. PGM's are highly sophisticated, and poor nations typically do not produce them. These states may acquire them through purchase (Egypt is an example), but the costs of development locate these weapons in economically affluent states. Therefore, based on the consensus of extant research, I assume that the superior technology and elevated costs associated with PGM's will lead the researcher to conclude that democracies are most likely to develop and possess such weapons. More analysis is necessary to thoroughly support this claim, but for the purposes of this study, it is assumed.

1.4 Precision and Duration

In summary thus far, PGMs increase the opportunities a state has to employ military force as the new capability opens additional options of employing force short of full scale warfare. Secondly, the reduced costs of employing force increase the willingness of decision makers (who are beholden to constituencies) to seize these additional opportunities to achieve desired foreign policy outcomes. Finally, possessing such capabilities adds a new dimension to a state's perceived power, not necessarily measured in quantity of military material, but in the increased flexibility of the state to employ effective and efficient means of coercing a target state. The final element of PGM evaluation in the literature rests on the duration of air campaigns. Duration is simply the

time elapsed from the initiation of hostilities to the conclusion of the air campaign. It is important to note that the conclusion can follow regardless of whether the campaign was successful or not. States could terminate a losing campaign just as well as a successful one. Much of the literature focuses on how to employ airpower in such a manner to ‘win’ the conflict, but the other possibility exists as well and must be included in the effects of PGM’s on conflict duration.

Precision technology alters the expectations that a target state can be successfully defeated or coerced. For example, an army could expend the lives of hundreds of soldiers to take an objective, or it can attain the same objective with a well-placed sniper outside of the range of the defenders. This technological capability reduces the costs of a mass assault, increases the willingness of the commander to order the objective to be taken, and gives the attacker an increased element of power to achieve the objective. As a result of this new environment, one must ask if this new capability is actually effective. I propose that a means to measure this effectiveness lies in the duration of the assault. If the objective is attained in a shorter time period than if the precision technology was not available, it is logical to assume that the technology may have contributed to the success of the campaign. Conversely, if the assault took longer to achieve the objective or was deemed a failure, then the use of precision technology may have little appreciable effect on the outcome. The existing literature on the effectiveness of air campaigns identifies many factors that contribute to success. These factors will be discussed in this section, but I propose a new factor (precision weapon technology) that can better explain the success of air campaigns.

Studies conducted on the effectiveness of coercive airpower have found that coercive airpower works when the attacking state correctly identifies and destroys the military vulnerabilities of the target state, and that the target state will resist longer if the coercer's demands are high enough (e.g. regime change) (Pape 1996; Horowitz and Reiter 2001). Additionally, the destruction of the target state's ability to counter-escalate against the attacker increases the success of coercive campaigns (Byman, Waxman, and Larson, 1999; Pape, 1996). These vulnerabilities must be identified before they are attacked, and military historians have often labeled these critical targets "centers of gravity." These centers-of-gravity are typically defined as targets where the enemy is most vulnerable, and if destroyed, would prove to be decisive in the successful outcome of the campaign (Warden, 1989). The early airpower theorists argued for competing ideas over what targets were critical. Douhet (1932) argued that civilian populations were the centers-of-gravity; in that, if sufficiently bombarded, they would pressure their governments to sue for peace. Others argued that attacking the target state's industrial infrastructure would weaken their ability to wage war and lead to the collapse of resistance (Mitchell, 1921). Clodfelter (2005) found that the Vietnam campaign succeeded when the strategy of the North Vietnamese changed to one that was more vulnerable to U.S. airpower. U.S. Air Force Colonel John Warden (1989) went so far as to articulate the theory of the "five rings," where the center-of-gravity was the command and control of adversary forces, followed by system essentials, infrastructure, population and finally fielded military forces. This theory was translated into an effective air strategy that led to the successful expulsion of Iraqi forces from Kuwait in 1991. Others posit that effectiveness is measured in more general terms such as regime type of the involved

states. The broadest literature simply concludes that democracies do not fight one another (Doyle, 1983; Russett, 1993), are ‘casualty-averse’ (Siverson, 1995), fight shorter wars (Bennett and Stam, 1996), and use unique strategies depending on the situations (Reiter and Meek, 1999; Clodefelter, 1995; Lambeth, 2001).

In line with this literature’s findings, shorter campaign durations are a product of whether one of the parties to the conflict is a democracy (Allen, 2007). Allen found that the presence of a democracy increases the likelihood of a shorter and successful air campaign, but she does not address ‘why’ a democracy is more successful. I argue that a democracy is more likely to develop and devote the resources (PGM technology) necessary to win a campaign in the shortest amount of time, therefore, it is not the democracy itself that is significant but the increased capabilities a democracy can bring to bear on the conflict. Clodfelter correctly identified the shift in North Vietnamese strategy that facilitated a successful air campaign, but he minimizes the role of PGMs introduced in 1972. It is these holes in the explanatory power of prior research that this study addresses. All of these studies, however, measure military capability in terms of relative military size or percentages of GDP dedicated to defense. PGMs add a new capability for the attacking state to exploit successfully the target’s vulnerabilities.

A specific measure of precision munitions is absent from these studies, and if the advances in military capabilities justify their use, systematic evaluation must be done on the level of efficiency these weapons are purported to possess and whether their use results in shorter and successful air campaigns. If so, then PGMs could be seen as a method of increasing a state’s power without the requisite reliance on a massive military infrastructure. The hypothesis developed is as follows:

H1: Increased employment of precision guided munitions will result in a shorter duration of successful aerial bombing campaigns.

In summary, PGM technology mitigates the costs typically associated with warfare, and existing findings can logically lead to the idea that these weapons increase the opportunities and willingness of a state to default to this capability as a “weapon of choice.” As the literature above illustrates, casualty aversion, determining the correct military strategies and regime type all play a role in determining the successful outcome of any coercive military campaign. PGM’s help translate these factors into the power to not only engage in coercive warfare, but to prevail. Additionally, the accuracy of these weapons virtually guarantees the destruction of the desired targets that any military strategy adopts, but the ultimate efficacy of coercive air power remains beholden to the identification of the proper centers-of-gravity. PGM’s act as the tool to implement any military strategy, but it remains true that success would be most likely only via the soundest strategies. It is important to note that technology is not a panacea to military defeat, but it can enable success if used wisely.

Separating the effects of these weapons from the context within which they are used is a difficult task, but this study is a first attempt in the literature to do so. The research design seeks to first demonstrate empirically that PGM’s do in fact influence the air campaign’s duration, but the following case studies will evaluate the role of PGM’s within the contexts of the military/diplomatic environments as well as the limitations placed on air forces via allies, popular opinion, and poor strategy formulation. The empirical results should stand on their own, but one should be cautious of drawing

sweeping generalizations regarding their efficacy to assure victory. This framework will be laid out next in the research design.

Chapter 2

Research Design

2.1 Universe of Cases

Measuring the effectiveness of coercive air campaigns is a daunting task. Air power has been employed as a coercive instrument since the First World War and continues to this day in the Middle East. The difficulty with isolating the effects of PGMs lies with their relatively recent advancement. Comparing historic air campaigns with modern ones presents the researcher with fundamental differences in the capabilities of the aggressor states. This study uses 55 air campaigns in a growing database that covers 1917-2003 (Pape 1996; Horowitz and Reiter 2001; Allen 2007). Aerial munitions from 1917 to 1970 were predominantly employed without precision guidance or aiming mechanisms. From World War I to the start of World War II, these weapons were aimed by natural sight; many times they were dropped by hand out of the side of an open cockpit aircraft. Aiming such munitions was a function of how well the aircrew judged the release point by their altitude, airspeed and wind conditions. By the end of World War II, sophisticated aiming mechanisms were mounted inside large bombers (e.g. the Norden Bombsight), and these devices could account for forward velocity and wind drift via rudimentary computers. During the two decades following the war, sophisticated onboard computers could speed up computations and receive real-time ballistic inputs from external sources, thus alleviating the labor intensive responsibilities of the aircrews to compute bombing solutions. Despite these advances, once the bombs were dropped, their trajectories were still dependent upon gravity, aerodynamic forces, and weather

conditions; they possessed no intrinsic guidance or control systems. The accuracy of the bombs remained relatively consistent and large formations of aircraft were required to ensure a minimal level of target destruction.

In the early 1970's, technology began to leap forward at an exponential rate. During the Vietnam Linebacker campaign, the introduction of Laser Guided Bombs (LGBs) fundamentally changed the nature of air warfare. These weapons had control fins that could correct errant flight paths and literally 'fly' the bomb into its intended target. Guiding the bomb itself was a laser beam that had to be concentrated on the target by a 'designator.' This designator was normally another aircraft equipped with the designator or ground personnel in close proximity to the target. This technology was predominantly used during Vietnam in the 1970's, during the 1986 Tripoli attack, and throughout the First Gulf War (1991).

The newest generation of PGMs debuted in 1995-1999 during the Balkans campaigns. These weapons were not only capable of correcting their flight paths, but they also had self-contained guidance computers that relied on GPS, thus eliminating the need for spotter aircraft or ground personnel. The bomb literally "knows" its current position and the position of the target, and it simply flies itself into the target much like an aircraft navigates from airport to airport. There is no longer a need for an external designator thus reducing the number of military personnel in the combat zone. It is a true "fire-and-forget" weapon that once released, needs no further action from the pilot.

The most recent advances occurred within the last fifteen years, thus complicating the task of keeping the background conditions constant in any time-series analysis of the

effectiveness of aerial bombing. Prior to PGMs, durations of air campaigns were relatively long (Combined Bomber Offensive, 1942-1945, Operation Rolling Thunder, 1965-1968). Once PGMs were introduced, those states employing them began to see dramatic reductions in the campaign duration. Operation Linebacker lasted six months, the First Gulf War air campaign lasted 42 days (ground forces extended the entire operation to 100 days), Kosovo lasted 78 days (no ground forces), and the Iraq “Shock and Awe” campaign took just 28 days to topple the Iraqi regime (2003) (Lambeth, 2001). There are significant differences between all three of these later campaigns. All three of these campaigns had differing levels of PGMs used. The First Gulf war used airpower in preparing the battlefield for ground troops (6% PGMs), Kosovo employed no ground troops (35% PGMs), and Iraq (2003) (50%+ PGMs) used airpower congruently with a ground invasion (Lambeth, 2001, Gillespie, 2006).

All of these factors confound attempts to isolate the effects of coercive airpower utilizing PGMs; however, if PGMs do have an effect on the duration of air campaigns the results should reveal this as they become more prevalently employed. Once introduced in 1972, their use was minimal compared to traditional “dumb” bombs, so their effects would likely be masked by the abundance of older munitions. As the numbers of PGMs increased in air campaigns their effects should become more salient. Granted, existing literature finds that the greatest effect on duration comes from being able to correctly identify the critical targets that exploit the adversary’s military vulnerabilities (Pape, 1996), but these targets take longer to destroy with traditional ballistic weapons. Once the proper targets are identified, PGMs should reduce the number of strikes required to ensure destruction, thus shortening the campaign. In addition, the overwhelming lethality

and the precision with which it is destroyed may play a role in forcing the target state to capitulate sooner as its ability to resist rapidly diminishes.

Studies of military capabilities focus mainly on the physical size of a state's military, arms races, and the percent of GDP spent on the defense budget; yet little attention has been paid to the actual technological capability of a state's forces. This measurement is crucial to understanding a state's ability to employ coercive airpower to address potential adversaries, protect national interests, or prevail in inter-state conflict. A measure of the precision of aerial munitions is a measurement of state power. A state possessing the capability to accurately deliver explosive ordnance globally and on short notice has expanded opportunities to directly affect the decision-making of competitor states. Intercontinental bombers can launch from their home countries, fly halfway around the world, and strike their targets without requiring the approval for forward basing in other states. Tactical aircraft can operate from aircraft carriers in international waters mere miles from adversary states providing time critical destruction of desired targets. Unmanned aerial drones can orbit above a battlefield for hours on end awaiting targets of opportunity without the inherent risk of losing a pilot to enemy defenses. While these capabilities increase the opportunities of states to affect the decision-making of adversaries, the use of PGM's reduces the associated costs typically associated with warfare. The virtual guaranteed accuracy of a single bomb reduces the number of aircraft, and thus pilots, needed to destroy the necessary targets to affect change in the adversary state. The opportunities to act with lower costs increases the willingness of a state possessing these capabilities to employ military force to advance its foreign policy.

A specific application of this measurement of power can be evaluated in the duration of aerial conflicts. Previous research has been conducted on aerial campaigns but without a precise measurement of the technological capabilities of modern air forces. This research will build on those findings by expanding the effects of precision on air campaign duration to the larger subject of state power. Allen (2007) conducted extensive research measuring the effects of coercive airpower, and out of 55 cases of applied coercive airpower she found that the presence of democracy on either side of the belligerents affected the duration of the bombing campaign. If a democracy was present on either side of the air campaign, the duration of the bombing campaign was shorter. However, she readily admits that a constraining factor in her analysis was the lack of precision in measuring the actual military capabilities of the belligerent's air forces (2007); thus the research lacks a tangible variable that could measure this aspect. She included a variable that measured whether a state was a great power or not, the logic being that more advanced states had more advanced militaries. This proxy measure can be refined, and the intent of this research is to expand upon Allen's analysis by providing a measure of the precision of air-dropped munitions and estimating a duration analysis based in this new information. This research will test for a relationship between aerial bombing duration and the degree of precision of the munitions dropped.

2.2 Data and Operationalization

The data set comes from the work of Horowitz and Reiter (2001), Allen (2007), and Pape (1996) where they document 55 cases of aerial bombing campaigns since 1917. The dependent variable (*months*) is simply the length of the bombing campaign in months (per the above-mentioned sources). The independent variables are as follows:

Attacker's Demand: This dichotomous variable (0, 1) measures the strength of the attacking state's demands on the target state. When the demand is high (such as regime change) the costs of concession are high and receive a 1. It is less likely that target states will concede the greater the costs. All other cases receive a 0.

Democratic adversary: This dichotomous variable measures whether the target state is a democracy or not.

Democratic attacker: This dichotomous variable measures whether the attacking state is a democracy.

Other forces: The effectiveness of airpower is often affected by the presence of other armed forces. This variable measures whether naval or ground forces also accompanied the air campaign.

Vulnerability to denial: This variable captures the target state's military vulnerabilities to hold the disputed territory with military (Pape, 1996). This vulnerability translates into the target state's leader's expectations regarding his/her ability to hold out against aerial bombardment. The more vulnerable the target state's military forces are to attack should undermine its resolve to resist the attacker. Vulnerability is rated as nil, low, medium, high, or very high (1-5).

Vulnerability to punishment: This variable captures the vulnerability of the target state's population to aerial bombardment. It is measured in the same manner as the vulnerabilities to denial variable. Many airpower theorists have argued that persistent bombing of the target state's populations will undermine its ability to maintain the

support of its own people. If the people turn on the government, there is the possibility that the government will follow with capitulation to the attacker's demands (Pape, 1996).

Major power attacker: This dichotomous variable measures whether or not the attacking state is a major power (per a Polity score of 7 or higher on the combined democracy-autocracy scale).

The final independent variable, and one that is absent from the Allen (2007) study, is the Circular Error of Probability (CEP). This variable measures the precision of aerial-dropped weapons, thus constituting the measurement of precision. Lower CEPs represent more precise weapons; however, in order to eliminate confusion with the signs of the results, I inverted this variable such that higher values represent higher precision. This inverted variable is named *accuracy* and is the primary variable of interest in the study. A brief explanation of the CEP is required prior to discussing its operationalization.

2.3 Circular Error Probable (CEP) Explained

Every modern aerial weapon is designated with a CEP value. This term is used to describe the proximity to a target that 50% of a given weapon will fall within range of, for example: If the CEP of a weapon is 5 meters, 50% of all rounds dropped will land within 5 meters of the target (Dugdale-Pointon, 2008). It is basically a standard distribution model applied to air-dropped munitions. To put this measurement in perspective, during World War II, aerial bombing (CEP of 3,000 feet) required that 9,000 bombs had to be dropped to get 90% to fall within the vicinity of intended target (Warden, 1989). As a result of this poor precision, thousands of bombers would have to be launched to assure merely marginal success in destroying the target. Sometimes, these

missions would suffer 60% casualties (600 men in a thousand-bomber raid) (Overy, 1980). Today, by contrast, advanced technology allows just one aircraft to drop one bomb and thus virtually assure the target's destruction with little risk to the safety of the pilot.

This measurement is calculated for all types of air-dropped munitions, and I have collected data on the numbers and types of munitions used in the 55 air campaigns in Allen's model. The most accurate CEP values for modern PGM's are classified by the Department of Defense; therefore, I have used only open-source material to collect the values for each campaign. Ideally, I would have collected data on the percentage of PGM's in relation to "dumb" bombs in order to weight the preponderance of precision; however, this data is not available for most cases (especially non-western states). Instead, the CEP calculated will be for the most precise weapons employed during the entire campaign. While not the strongest data fidelity, this approach will capture the most precise weapons available at the time and provide the necessary variation. Since air campaigns are predicated upon attacking the most vital targets to ensure success, it is logical to assume that the most precise weapons of the day would have been used against these centers-of-gravity. In future research, I will attempt to measure CEP as a proportion of all bombs dropped, as a lack of data prevents such a fine-grained operationalization. I expect states that applied air power with higher precision weapons to have shorter bombing campaign durations.

Replicating the same methods used by Allen (2007), I will conduct a duration analysis (Cox regression) to estimate campaign length (months) and discern the factors that influence the time until the campaign ends. The assumption is that shorter campaigns achieved their objectives more rapidly. Allen (2007) takes into account that coercing

states may terminate “losing” campaigns earlier, and she therefore disaggregates her model into campaigns that ended in either success or failure. In an attempt to capture the dynamics of cases that end in either success or failure, Allen (2007) uses a paired duration analysis. Simply stated, in any given month, each campaign has some risk of ending in either success or failure, therefore in addition to the basic model, two additional models are needed to capture these competing risks. The basic model will examine all cases regardless of outcome; the second model will examine cases that ended in success, the third, cases that ended in failure. I will present Allen’s results first, and then evaluate the same regression with the addition of the CEP variable of precision. With the inclusion of the CEP variable, I will analyze the complete model with all cases, the cases that ended in success, and the cases that ended in failure.

Additionally, I will execute a fourth model on cases from 1970 to the present. In the early 1970’s we see the first significant employment of PGMs in an air campaign, therefore this model will test if the duration of air campaigns prior to PGM development is masking the effects PGMs had as they became more prominently employed. This aspect will be discussed in more detail following the results of the data. To illustrate, air campaigns during World War II lasted for years since the targets could not be effectively destroyed. Also, the identification of the critical targets that could force capitulation was unsuccessful during most of the war. Finally, the militaries of Germany and Japan were extremely advanced in capability and training than states such as modern day Iraq, Afghanistan, Libya, etc. If vulnerability to denial is a critical factor in duration (Pape, 1996), then the Germany and Japan examples could be affecting the results of much later cases (post 1970). PGM technology advanced since its inception, its levels of

employment have increased dramatically, and the risks of collateral damage associated with their use have also decreased; therefore, I expect to see more salience since they were introduced in 1970 as well as their significant advances in usage and lethality.

2.4 Operationalization of the CEP

CEP specifications are typically arrived at via flight testing of munitions. Such flight tests are conducted by states with advanced military capabilities; therefore some states do not have reliable data on weapons' CEPs. The United States conducts most of these tests, but states such as Iraq, Iran, Afghanistan, and Pakistan do not provide data on their own weapons. Fortunately for this study, many of the weapons employed by second and third world states were purchased from the United States (or other western states), and while many foreign military sales intentionally degrade capabilities of exported weapons, the tests conducted by the western great powers can be used to approximate the precision of weapons in a wide range of air campaigns.

Realized CEP's can vary depending on the tactics and procedures used in the delivery of air munitions, and not all munitions have been tested to establish highly accurate values. Military studies literature generally assigns a CEP of 3,300 feet during the World War II era, 1,000 feet during the Korean conflict, 400 feet during the early years of Vietnam, and around 40 feet in the post-1972 era of modern PGMs (Hallion, 1995). To remain consistent in the generally accepted values in prior literature, I use these as a baseline for assigning CEPs to lesser airpower conflicts such as in Nigeria (1960s), Algeria (1950s), Iraq/Iran (1980s), and Afghanistan (1987). Ballistic high-altitude bombing (World War II) received a CEP of 3,300 feet; dive bombing campaigns received a 1,000 foot CEP since lower drop-altitudes increase precision (Hallion, 1995).

States employing second and third generation aircraft also received a CEP of 1,000 feet because they typically dropped in a dive or had an onboard trajectory computing system (Hallion, 1995). If a state possessed PGMs (Laser- and Optically-guided variety) they received a CEP of 400 feet; if the PGMs possessed autonomous guidance systems (GPS), they received a 40 foot value (Hallion, 1995).

I recognize that these values are estimated, but they provide the necessary contrast between the precision and capability of the air forces involved in the air campaigns. Other factors include whether or not the air campaigns included helicopters in addition to tactical/strategic strike aircraft (e.g. Soviet war in Afghanistan). These types of campaigns received a 1,000 foot CEP, because while they employed “dumb” bombs, the altitudes were usually very low and the helicopters operated in close proximity with ground forces, thus improving overall precision. These estimates, while not perfect, are sufficient to draw the necessary contrast between the different air campaigns while maintaining the proper levels of scale involved in measuring relative military capabilities. Future studies should provide more inter-coder reliability by subjecting the CEP assignments to official aircraft munitions data that can refine the estimates.

As an example to describe the contrasting precision of aerial delivered bombs, one can evaluate the advances in PGM's from World War II to the Vietnam air campaign in 1972. During World War II, the U.S. Army Air Forces employed the B-17 bombers as the primary strategic aircraft operating over Europe. The munitions dropped over Germany possess a CEP of approximately 3,300; to place this in practical terms, it took 108 B-17's, 1,080 crewmen, and 648 bombs to attain a 96% chance of just two bombs hitting within a 400' x 500' German power plant (Hallion, 1995). Contrast these

capabilities with those in Vietnam, where munitions with a CEP of 400 required only one strike aircraft and two crewmen to virtually assure destruction of the target with just two laser-guided bombs (Hallion, 1995). It is important to note that the CEP is not just dependent on the bomb itself; one has to consider the capabilities of the delivery systems and aircrew training. During Vietnam, the aircraft dropping a laser-guided bomb may need another aircraft equipped with the laser used to “illuminate” the target. The addition of another aircraft and its systems increases the risk of mechanical malfunction that could degrade the realized accuracy of the weapon. External factors such as weather, mechanical malfunction, pilot skill or adversary defenses can all act to degrade the successful delivery of any weapon. Therefore, the values I assign, while based on general consensus of prior literature, are not perfect and subject to errors in the weapons’ realized precision.

While CEP is the primary measure of weapon accuracy, the manner in which it is measured could create confusion in the results. Specifically, lower CEP values represent more accurate weapons, while higher CEP values represent less accurate weapons. Statistical analysis of this variable could lead to negative signs that may be confusing to the reader; therefore, I simply inverted the values of this variable to provide a reversed scale of accuracy measures by subtracting all CEP values from the largest value (3,300). The variable of interest (while derived from CEP values) is ‘*accuracy*.’ Now, lower accuracy values represent lower precision, and higher accuracy values represent greater precision. This modification will ensure the return of positive values and prevent confusion. The table below (Table 1) illustrates this conversion and gives the reader relative values:

Table 1: CEP to Accuracy Comparison

<i>CEP</i>	<i>Accuracy</i>
10	3291
20	3281
30	3271
400	2901
1000	2301
2000	1301
3300	1

2.5 Model Specification

The unit of analysis for this study is *accuracy* (converted from CEP) and its effects on the duration of air campaigns. I will analyze air campaigns from 1917 to 2003 in accordance with the previous research designs per Pape (1996), Horowitz and Reiter (2001) and Allen (2007). In some cases, the air campaigns themselves are a part of a larger war (World War II for example); however, these campaigns are treated discreetly within the larger context of the war. Each campaign possessed stated goals and objectives, and the measurement of each campaign's duration and effectiveness are treated specifically regarding these goals. For example, World War II had several air campaigns (Battle of Britain, Combined Bomber Offensive, Normandy invasion interdiction campaigns), but each one is analyzed separately to capture the efficacy of attaining their stated objectives.

The statistical procedure used is a paired-Cox regression duration analysis to estimate the campaign length of each case. In the first level of analysis, I focus on all campaigns regardless of whether they were successful or not. This analysis is congruent with the Allen (2007) methodology; however, I will introduce the accuracy variable to test its effects on duration.

In a second analysis I will disaggregate the campaigns as *successes* or *failures* and test the effects of accuracy dependent upon the outcome. Here I make an assumption that shorter campaigns should be successful ones, after all, it is logical to assume that a state is less likely to continue a failing campaign.

Finally, I run a third model that only analyzes the effects of accuracy on campaigns after 1970. This year saw the first employment of PGMs in appreciable numbers. The technological advancement of PGMs grew significantly in this time period, and it is after 1970 that greater degrees of variance occurred in the independent variable. 1970 saw the introduction of laser-guided bombing systems, but while these weapons were significantly more accurate, they still relied on a third-party spotter to guide the weapon onto target. This characteristic increased the human-error that could occur and was still subject to weather and other visibility factors. By the 1990's, autonomous guidance systems (GPS) virtually eliminated the reliance on ballistic computations, human control, and weather factors, as aerial weapons were increasingly able to guide themselves to the target without requiring real-time knowledge of atmospheric conditions characteristic of bombing from 1917 to the present.

Cox survival analysis

This study estimates the duration of a given air campaign using a Cox survival analysis. In this case, the event is the duration of the air campaign starting at some time t . Subsequently, the air campaign is 'at risk' of experiencing a change in its state (termination). The survival method analyzes the 'risk' of the air campaign terminating through a probability calculation,

$$\text{RISK} = \frac{\text{Pr (Failure)}}{\text{Pr (Survival)}}$$

where the Pr(Failure) is the Pr(campaign termination) and Pr(Survival) is the Pr(campaign continues). This risk ratio is also called a *hazard ratio (HR)*, which is reported in the results. This methodology links the independent variables in the Allen (2007) study and the *accuracy* variable to the occurrence of the air campaign terminating.

One last clarification regarding the usage of the Cox model is necessary due to the coercive nature of airpower. As Allen (2007) points out, there is a probability that the campaign will end in either success or failure, and the likelihood of either of these outcomes represents ‘competing risks.’ “Because different decision makers control these two distinct choices, there is additional information to be gleaned by modeling them separately” (Allen, 2007, p. 120). I replicate Allen’s method by using a paired Cox model to analyze the duration of both successful and failed air campaigns.

After replicating the Allen model with the *accuracy* variable, I will be able to estimate the effects of PGMs on aerial campaign duration. While Allen (2007) found that campaigns tended to be shorter when one of the involved states was a democracy, I posit that democracies typically have more advanced air force capabilities. In the instances of air campaigns, these advances come in the form of PGMs. It matters less that the state was a democracy and more that the democracy has an air force with greater capabilities. PGMs are expensive to test and develop, they require delivery systems that can overcome distance and time constraints, and they require extensive training so operators will know how to use such complicated weapons systems. Additionally, democracies typically have the robust economies necessary to fund such weapons systems.

Finally, attention must be paid to the potential selection effects in including cases where air campaigns predominately occurred. There are four cases in the Allen (2007) dataset that never escalated to an air campaign, but to increase robustness, I integrated the Allen cases into the International Military Intervention (1947-2005) (IMI) dataset developed by Pearson and Bauman (1993) and Kisangani and Pickering (2008). There are 1,141 cases of armed conflict, most of which did not have an air campaign. More analysis of the endogeneity issues is discussed in the results chapter.

2.6 Case Studies

As the literature suggests, there could be many factors that determine the duration, success, and failure of any coercive air campaign. In order to evaluate the context in which PGM's are employed in warfare, I chose two case studies to discern the nuances of waging such campaigns. Political, military, economic, and military strategy conditions can all have an impact on the success or failure of an air campaign. The regime type and political support within could affect resolve of the target state; poorly devised military strategy, political constraints of the attacking state, and the type of war being waged could affect the conflict prosecution of the attacking state. To avoid making sweeping generalizations regarding the efficacy of PGM's on conflict duration, these two case studies will highlight some of the nuances in the Vietnam (1965-1972) and Kosovo (1999) air campaigns.

The Vietnam campaigns were two distinct air operations, Operation Rolling Thunder (1965-1968) and Operation Linebacker I/II (1972). A significant difference

between these two campaigns occurred; Rolling Thunder was conducted without PGM's, but Linebacker I/II saw the introduction of the first Laser- and Optically-guided weapons. The latter campaign is generally accepted as a success, but other conditions (political/military) prevailed that will be evaluated in the study. The second case study (Kosovo-Operation Allied Force) was conducted as solely an air operation; no ground troops were ever employed. Additionally, the number of PGM's employed had tripled since Vietnam, and the munitions were now capable of GPS internal guidance systems. Accuracy increased exponentially, but the war lasted longer than some previous campaigns raising the possibility that additional factors were in play.

One reoccurring theme throughout the case studies is the intensity with which each air campaign was prosecuted. U.S. President Johnson was under political pressure from an unpopular war and thus adopted a gradual escalation policy in waging the air campaign. This approach never inflicted enough hardship on the Hanoi regime to force concessions, and his military chiefs were persistently arguing for a more intensity. In contrast, the Nixon administration was under pressure to extricate the U.S. from the conflict under a favorable peace deal. His prosecution of the Linebacker campaign increased the intensity never before seen since World War II. The Linebacker campaign succeeded in brokering a peace with the North Vietnamese, thus allowing the exit of U.S. forces. The Kosovo campaign saw a combined strategy of both gradual escalation and high intensity. The initial days of bombing against the Milosevic regime failed to stop the ethnic cleansing of Albanian Muslims. The campaign of violence against this population actually increased after the bombing began. It was not until the latter half of the war that more aircraft were devoted to the bombing, increasing the intensity by increasing

firepower and opening up industrial infrastructure targets. This escalation is believed to have significantly weakened Milosevic's domestic support to the point that he finally gave in to NATO demands.

The quantitative portion of this study finds that the increased employment of PGM weaponry reduces the duration of the air campaign; however, while the Vietnam air campaigns appear to support the statistical findings, the Kosovo air campaign appears to defy them. The Linebacker campaign in Vietnam witnessed the first use of PGM weapons, and the campaign was successful in bringing the North Vietnamese to the negotiating table twice in only 6 months. The prior attempts in the Rolling Thunder campaign endured for 3 years without any tangible concessions by Hanoi. The survival analysis (Chapter 3) shows that precision technology has a statistically significant effect on duration, but the Linebacker campaign only used PGM's in less than 10% of the total ordnance dropped. Contrast this with the Kosovo campaign, where 35% of all munitions were PGM's but the campaign (while successful) lasted 78 days, and Milosevic's final concession took NATO by surprise (Hosmer, 2001). This suggests that while PGM's are effective at reducing the duration of conflict, something else is at play as well. It is the purpose of these case studies to discern those nuances. Both case studies highlight the political, social and military factors that can affect an air campaign's outcome and duration.

2.7 Conclusion

This study takes a multi-method approach with both quantitative analysis and qualitative case studies to discern the effects of PGM's on aerial conflict duration. The Cox-survival model remains consistent with previous research but adds an additional explanatory variable, CEP (accuracy). While the operationalization of CEP has its drawbacks (data limitations), it is sufficient to represent the contrast between aerial delivered weapons development throughout the twentieth century. It is important to stress that these findings should not be extrapolated too broadly to any past or future air campaign, but it does represent a new way of analyzing the efficacy of coercive air campaigns. States operating under the current international system will continue to exercise power to influence other states, and PGM's provide an extra source of power to achieve national interests in the most severe circumstances.

Chapter 3

Results and Discussion

3.1 Descriptive Statistics

The dataset comprises 55 air campaigns since 1917 with varying degrees of accuracy commensurate with the technology of the day. Four of the cases never escalated into an actual air campaign (Cuban Missile Crisis, Suez Canal standoff (x2), and a crisis in 1938 between Great Britain and Germany). These cases were included to maintain consistency with the Allen (2007) methodology. Despite these omissions, all of the cases occurred prior to 1972, the period when PGM technology predominately occurred. It is safe to assume that the precision technology of the states in these missing cases (China, Taiwan, Germany, Great Britain, USSR, and the U.S.) all possessed aerial weapons similar in precision capabilities. Little variation would have occurred in these early days of precision technology.

Table 2 displays the summary statistics of the first model. A few factors stand out in light of the results below, so these will be briefly explained before I report the survival analysis results. First, air campaigns involving other forces (ground/naval) account for 75% of the sample. The addition of these forces tends to lengthen the air campaign (coeff -0.83), possibly due to the increased commitment of a state that elected to use additional forces. Secondly, the target states' militaries were generally vulnerable to denial strategies (avg 3.02) thus supporting Pape (1996), Byman, Waxman, and Larsen's (1999) findings that campaigns were more decisive as they eliminated the target's ability to counter-escalate the conflict. Finally, major-power-attackers comprise almost 70% of the

sample, and these states are most likely to have the economic resources to develop and employ PGM weapons.

Table 3.1 Summary Statistics for All Air Campaigns (1917-2003)

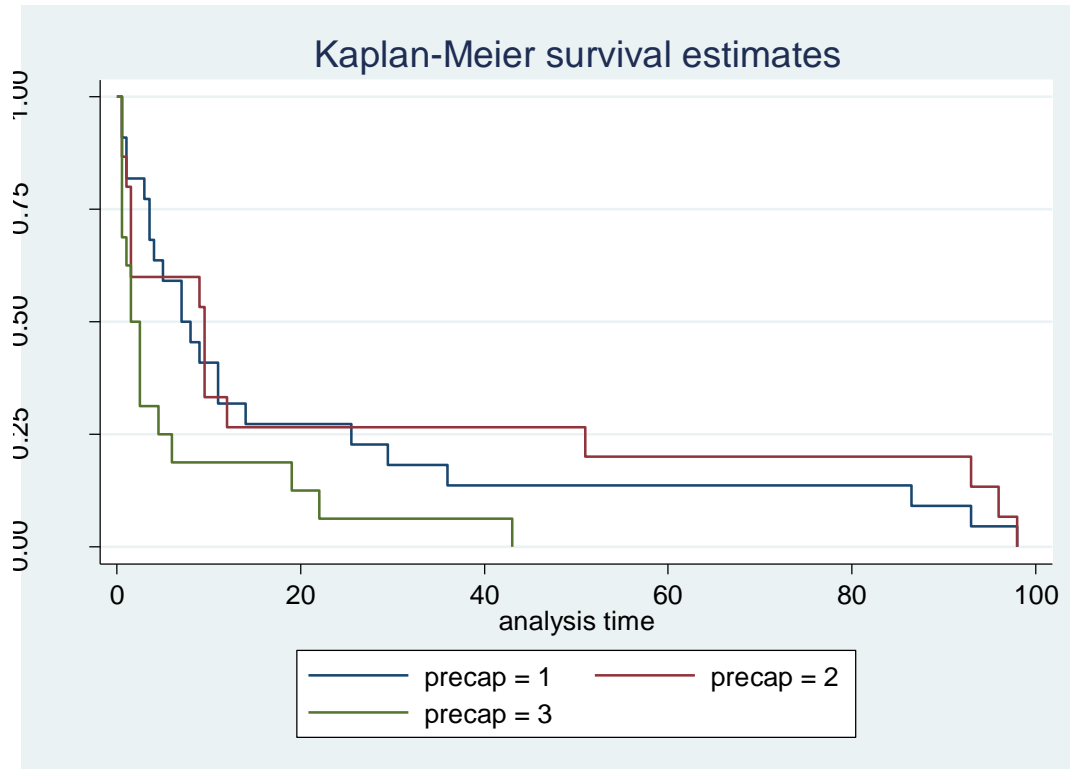
Variable	Observations	Mean	Std. Deviation	Min	Max
Months	55	17.47	29.14	0.5	98
Accuracy	54	1826.9	1177.4	1	3291
Other Forces	55	0.745	0.439	0	1
Democracy	55	0.164	0.373	0	1
Democratic Attacker	55	0.545	0.502	0	1
Attacker's Demand	55	0.364	0.485	0	1
Vul. To Denial	55	3.02	1.06	1	5
Vul. To Punishment	55	2.71	1.05	1	5
Major Power Attacker	55	0.691	0.466	0	1

The next descriptive is a Survival Function Table (Table 3.2). This table shows the percentage of cases that “survive” (fail to terminate) in each month period. 27% of all campaigns terminated in the first month, and then there is a decline in the termination rate in the remaining cases. The survivor function represents the percentage chance that a given campaign will continue (not fail). To better represent the trends in survivability, this function is graphed (Figure 3.1) in a Kaplan-Meier Survival Function Table by three subgroups of precision capability (precap): Precap 1 represents the lowest precision capability air campaigns ($1,000 < CEP < 3,300$); Precap 2 represents medium precision capability campaigns ($400 < CEP < 1,000$); and Precap 3 represents the highest precision capability campaigns ($CEP \leq 400$). The resulting graph demonstrates that higher levels of precision in a given campaign results in the lowest survival rates, meaning the precise campaigns are more likely to terminate earlier. The graph appears to validate the hypothesis of this research, but more statistical analysis is required, and the Cox survival analysis will be addressed next.

Table 3.2 Survival Function for All Air Campaigns (1917-2003)

Time	Beg. Total	Fail	Survivor Function	Std. Error	95% Conf. Int.	
0.5	55	11	0.80	0.054	0.67	0.88
1	44	4	0.73	0.06	0.59	0.83
1.5	40	5	0.64	0.06	0.50	0.75
2.5	35	3	0.58	0.07	0.44	0.70
3	32	1	0.56	0.07	0.42	0.68
3.5	31	2	0.53	0.07	0.39	0.65
4	29	1	0.51	0.07	0.37	0.63
4.5	28	1	0.49	0.07	0.35	0.61
5	27	1	0.47	0.07	0.34	0.60
6	26	1	0.45	0.07	0.32	0.58
7	25	2	0.42	0.07	0.29	0.54
8	23	1	0.40	0.07	0.27	0.53
9	22	2	0.36	0.06	0.24	0.49
9.5	20	3	0.30	0.06	0.19	0.43
11	17	2	0.27	0.06	0.16	0.39
12	15	1	0.25	0.06	0.15	0.37
14	14	1	0.24	0.06	0.13	0.35
19	13	1	0.22	0.06	0.12	0.33
22	12	1	0.20	0.05	0.11	0.31
25.5	11	1	0.18	0.05	0.09	0.29
29.5	10	1	0.16	0.04	0.08	0.27
36	9	1	0.15	0.05	0.07	0.25
43	8	1	0.13	0.04	0.06	0.23
51	7	1	0.10	0.04	0.04	0.21
86.5	6	1	0.09	0.04	0.03	0.18
93	5	2	0.05	0.03	0.01	0.13
96	3	1	0.04	0.03	0.00	0.11
98	2	2	0.000			

Figure 3.1 Survival Estimates per Month of Air Campaign Duration



3.2 Cox Survival Analysis: All Cases (1917-2003)

Model 1 (Table 3.3) represents all cases from 1917-2003 and does not disaggregate between successful and failed campaigns. These results consider the risk of the campaign ending, where positive coefficients represent factors that increase the likelihood of the campaign ending in a given time period. Additionally, hazard ratios that are < 1 indicate factors that decrease the likelihood of a campaign ending.

Three factors stand out when accuracy is added to the original Allen analysis: 1) if there is a democratic adversary, the campaign's likelihood of terminating drops slightly, but it is still almost 3 times as likely to end. The coefficient remains positive, becomes slightly less responsible for campaign termination (1.06 to 1.02) but increases in

significance ($p=0.01$); 2) as the target state's vulnerability to denial increases, the campaign approaches twice as likely to end in a given time period. The coefficient increases slightly (0.56 to 0.63) and remains positive and statistically significant ($p=0.0$); 3) when other forces (ground/naval) are involved, the coefficient increases in significance (p value drops from 0.01 to 0.0), but remains negative and becomes less responsible for campaign termination; 4) the accuracy coefficient is positive, but it is not significant.

Adding the accuracy variable does not significantly alter the original Allen (2007) results when applied to all cases. Regime type (the presence of a democracy) (Allen, 2007), the target state's vulnerability to denial (Pape, 1996; Horowitz and Reiter, 2001) remain important and significant. Additionally, the presence of other forces also tends to drag out the campaigns as more resources and sunk costs tend to exist in such conflicts, thus possibly strengthening resolve to continue fighting. The relatively few cases of precision weaponry, however, in the earlier periods may account for PGM's effects being washed out in the data, but this issue will be addressed in Model 3 later.

Table 3.3 (Model 1)
Cox Regression: Duration of Bombing Campaigns w/Accuracy (1917-2003)

Variable	Coefficient (Allen) (Std. Error)	Coefficient (Accuracy) (Std. Error)	Hazard Ratio (Allen)	Hazard Ratio (Accuracy)
Democratic Attacker	0.489 (0.361)	0.55 (0.325)	1.63	1.73
Democratic Adversary	1.068* (0.434)	1.02** (0.41)	2.91	2.77
Vulnerability to Punishment	-0.159 (0.197)	-0.14 (0.19)	0.853	0.87
Vulnerability to Denial	0.560** (0.166)	0.63** (0.14)	1.75	1.87
Attacker's Demand	-0.244 (0.237)	-0.06 (0.24)	0.784	0.94
Other Forces	-.610* (0.336)	-0.83** (0.31)	0.543	0.44
Major Power Attacker	0.122 (0.304)	0.09 (0.31)	1.13	1.09
Accuracy		0.0002 (.0002)		1.0002
<i>N</i>	55	55		
Log-likelihood	-157.109	-151.57		
Chi Sq	22.135	73.77		

Significance Levels: *0.05, **0.01

Following Allen's lead, Model 2 breaks down the effect of accuracy on duration by campaign outcome, and these estimates are displayed in Table 3.4. Recall that whether or not a campaign ends in success or failure is determined by different decision makers operating independently of one another, therefore a semi-parametric Cox analysis is necessary to treat the cases in each outcome separately (Allen, 2007). To accomplish this paired Cox analysis, air campaigns that ended with these two different outcomes are modeled separately and the results are as follows:

Table 3.4 (Model 2)
Competing Risks Model: Bombing Campaigns with Accuracy (1917-2003)

Variable	Success Model (Allen)	Failure Model (Allen)	Success Model w/Accuracy	Failure Model w/Accuracy
	Coef. (Std Err)	Coef. (Std Err)	Coef. (Std Error)	Coef (Std. Error)
Democratic Adversary	-0.152 (.738)	1.404**(.541)	-0.73 (0.60)	0.97** (.43)
Democratic Attacker	-.682 (.709)	.978* (.438)	-0.04 (.60)	1.27***(.51)
Attacker's Demand	-.148 (.609)	.189 (.374)	0.16 (.62)	0.09 (.45)
Vulnerability to Denial	1.344**(.414)	.057 (.203)	1.37***(.384)	0.11 (.20)
Vulnerability to Punishment	-.627 (.455)	-.149 (.241)	-0.51 (.44)	-0.06 (.27)
Other Forces	.774 (.824)	-1.234** (.358)	0.07 (.79)	-1.35***(.34)
Major Power Attacker	1.169 (1.252)	-.138 (.377)	1.05 (1.1)	-.26 (.44)
Accuracy			0.0004* (.0002)	-0.00001 (.0002)
<i>N</i>	55	55	54	54
Times at Risk	961	961	961	961
Log-likelihood	-42.651	-103.534	-41.84	-99.54
Chi Sq	38.9	39.423	37.68	43.78

Significance Levels: *0.10, **0.05, ***0.01

Significant differences after adding the accuracy variable are as follows: 1) in the failure model, when the adversary is democratic, the coefficient drops from 1.4 to 0.97 but remains statistically significant; 2) also in the failure model, when the attacker is democratic, accuracy increases the likelihood of a campaign ending (0.97 to 1.27, $p=.001$). This suggests that democracies with higher PGM usage will terminate a campaign earlier if it appears to be failing. This could account for the higher expectations of success; if such success is not apparent, then the conflict is terminated.

The success model shows a significant effect regarding the target state's vulnerability to denial. The coefficient increases slightly but its significance increases from 0.05 to the 0.001 level. This finding is again consistent with Pape (1996), Horowitz and Reiter (2001) and Byman, Waxman, and Larsen (1999) that coercive air campaigns are most successful when the adversary's military vulnerability is exploited. It is logical to assume that such campaigns should end in success if the attacking state is able to effectively neutralize the adversary's ability to fight back or counter-escalate. Finally, the accuracy variable itself only slightly explains early campaign termination in the success model (coeff 0.0004), and it's significance only reaches the 0.1 level.

One interesting effect of adding the accuracy variable is the drop in the democratic attacker coefficient (-0.68 to -0.04) in the success model. After running the competing risks model, while omitting the democratic attacker variable, accuracy's coefficient drops from 0.0004 to 0.0003 and remains significant at the 0.1 level. The vulnerability to denial coefficient drops from 1.37 to 1.29 and remains statistically significant at the 0.001 level.

As stated above, states conducting air campaigns prior to 1970 did not possess precision technology. The effects of accuracy, therefore, would not have been as prevalent and which could dilute their effectiveness when all air campaigns are considered. To address this dynamic, I ran the same Cox analysis on the air campaigns occurring only after 1970, the year PGM's were first employed in combat operations. Those results highlight the salience of PGM's effects on campaign duration and are presented next.

3.3 Air Campaigns Post-1970

Air campaigns prior to 1970 make up a majority of the cases in the data set used above, and in those precision weaponry was largely absent. Additionally, only a handful of post-1970 cases employed precision weapons, as many of these conflicts were low-intensity in nature and often protracted irregular wars fought by states with low airpower technology. It may be possible, therefore, that the effects of PGMs are being washed out in the cases where they were undeveloped. To explore this possibility Model 3 will evaluate the effects of PGMs in the context of their existence and development. The first significant use of PGMs occurred in the latter half of the Vietnam War, led by the United States. Only counting the cases after this time period may tease out the more salient effects of PGMs on air campaign termination. However, the number of cases in this model drop from 54 to 23; therefore the smaller sample leads to some skepticism regarding the generalizability of the results.

Table 3.5 (Model 3)
Competing Risks Model: Bombing Campaigns with Accuracy (1970-2003)

Variable	Overall 1970-2004	Success Model 1970-2004	Failure Model 1970-2004	HR Success	HR Failure
	Coef (Std Err)	Coef (Std Err)	Coef (Std Err)		
Democratic Adversary	-1.92***(.77)	-2.7*(1.63)	-.423(1.57)	.14	0.67
Democratic Attacker	1.39***(.55)	-4.35(--)	1.68*(1.05)	4.0	0.013
Attacker's Demand	1.12 (.75)	-.49(1.3)	2.77**(1.29)	3.06	.61
Vulnerability to Denial	1.46***(.59)	1.06**(.54)	1.31(1.02)	4.31	2.87
Vulnerability to Punishment	-1.07***(.26)	-.51(.56)	-1.22*(.69)	.34	.60
Other Forces	-2.42***(.53)	37.6(--)	-4.03***(.94)	.09	2.29
Major Power Attacker	-3.62***(1.2)	-2.23(1.7)	-3.9*(2.26)	.03	.11
Accuracy	0.003***(.001)	0.002**(.001)	0.002 (.001)	1.003	1.002
<i>N</i>	23	23	23		
Times at Risk	437	437	437		
Log-likelihood	-36.1	-13.1	-18.75		
Chi Sq	89.43	83.61	68.12		

Significance Levels: *0.10, **0.05, ***0.01

After accounting for just those cases after PGMs were introduced in significant numbers, accuracy appears to have a slight positive effect ($p=.001$) on the likelihood that a successful air campaign will terminate. This effect is not prevalent, however, in campaigns that end in failure. Democratic attacker and vulnerability to denial still have a significant effect, indicating that the ability for a democracy to increase the vulnerability of the target state increases the likelihood of a successful air campaign terminating by a factor of four. The introduction of other forces (ground/naval) has a strong negative effect on the likelihood of termination, but this appears intuitive in light of the fact that ground forces tend to draw out the durations of campaigns as the air forces shift to supporting the ground troops after the ground offensive begins. The impact of PGMs on air campaigns occurs strongest only during successful air campaigns, which may lend support to previous literature regarding the costs democracies incur by employing military forces. If the political leadership decides in favor of 'war,' there is generally a large expectation

that the war will be won, lest the political consequences of a loss jeopardize the office holdings of the decision makers. Conversely, if the war is seen as ‘lost,’ then the democratic state may seek to terminate the campaign quickly to mitigate any of these domestic costs. In the context of democratic constituency expectations, accuracy appears to slightly increase the chances of an air campaign terminating sooner when the outcome is ‘success.’

3.4 Addressing Selection Effects

There is a potential selection bias associated with evaluating only cases where an air campaign occurred. Heckman (1979) noted that selection bias can occur when the data units self-select into the phenomenon being studied or when the researcher selects only the cases where the phenomenon being studied occurred. In the case of studying air campaigns, there could be unobserved factors that lead certain states to select into or out of the conflict, thus representing an omitted variable bias. Heckman’s approach to address this limitation focused on regression models; however, scholars have since applied this approach to probit and survival models. Ideally, there would be a Heckman model to address selection bias in a Cox regression, since this method was used by Allen (2007), but such a model is currently unavailable. An alternative method was developed Boehmke, Morey and Shannon (2005, 2006) specifically to address duration studies. This model “estimates an exponential, Weibull, or lognormal model accounting for potential non-ignorable selectivity using maximum likelihood techniques” (Boehmke, Morey, Shannon, 2005, 2006).” Even this model, however, has its drawbacks. Allen points out that the non-monotonic nature of the hazards requires a “semi-parametric model” to

evaluate the data (2007); not accounting for this characteristic would violate the basic assumptions of the Weibull model. For this reason, she runs a “success” and “failure” model with a paired Cox regression, an approach that I replicate in this study. I recognize the limitations of using the duration selection Weibull model in this study; however, it provides a middle-ground compromise between the original Heckman model and the absence of a Heckman-Cox model. This compromise allows me to address the selection bias while remaining consistent with the Allen (2007) methodology.

As I report in greater detail below, there are no appreciable differences between the Heckman and the original Cox regression models. My base for testing the selection effects is the International Military Intervention (1947-2005) (IMI) dataset developed by Pearson and Bauman (1993) and Kisangani and Pickering (2008). Since Allen (2007) only provides 4 cases where air campaigns were not initiated, I merged her 55 cases into the IMI. This dataset comprises 1,141 international disputes that escalated to various stages of conflict from 1947 to 2005. By merging the Allen cases, I can run the duration-selection model (Boehmke) to determine what factors contribute to the target state’s selection into the air campaign.

The Cox regression revealed that PGM’s significantly affected the duration of the air campaign only in the post-1970 model. Since selection bias can affect the statistical significance, I ran the Heckman model on ALL cases from 1917-2005 and on just the post-1970 cases to discern the effects of both. Regardless of the precision of the weapons employed, target states still have to select into or out of the air campaign. This decision may be influenced by the level of precision, but it is logical to assume that as PGM’s advanced in capabilities (post-1970) this characteristic may have weighed more heavily

on the target state's decision. Running selection models for all cases, as well as the post-1970 cases may shed light on this decision making process.

I address the selection problem in two ways. First, I expect that any selection effects actually make it less likely that I will find a significant effect of PGMs on air campaign duration, because target states of coercive threats will select themselves into a bombing campaign only when they feel powerful enough to survive the devastation of aerial attacks. Therefore, given a challenger with a large amount of PGMs, only the stronger (or more resolved) targets are the ones that will resist, and this will have the effect of making the campaigns last longer, as the attacker has to work harder to defeat the resolve of a more powerful state. A weaker state, by contrast, cannot resist the onslaught; therefore it should acquiesce in the face of a coercer with advanced PGM capabilities. Since only the stronger states would theoretically resist a coercer's air campaign threats, this selection into the campaign should work against my hypothesis and make the air campaigns longer for challengers with large PGM capabilities. In contrast, for challengers that do not possess large PGM capabilities, they should not face the same selection effects, and some weaker and less resolve targets will in fact resist. All else equal, this reduces the average duration time of air campaigns for weaker challengers.

The selection model relies on both a selection equation and a duration equation. The duration equation estimates the length in *months* of a given air campaign with variations in *accuracy*. The selection equation estimates the likelihood that a state will select into the air campaign based upon certain variables. The *air2* variable records when a state selected into an air campaign, and the independent variables explain whether a

state selects into an air campaign. The explanatory variables originate from the IMI dataset, and a brief description of each of these variables is listed below (for more detailed information on variable coding see IMI codebook):

Source of intervention (source): This variable captures whether a state physically crossed the border into another state, or whether a state maintained a troop presence in the other.

Direction of intervener supporting action (direction): This variable captures the nature of the intervention. The intervening state could have remained neutral, supported/opposed the target state government, supported/opposed rebel forces, or support/oppose a 3rd party government.

Type of troop activity (type): This variable captures the nature of any troop incursions by the intervening state. Troop actions range from evacuation of personnel to actual combat operations.

Naval incursion (naval): This variable captures whether or not naval forces were used by the intervener. Actions range from evacuation of personnel to active firing/shelling of target state forces.

Domestic dispute (domestic_dispute): This variable captures whether the intervener took part in a domestic dispute in the target state.

Affect domestic or foreign policy (affect_policies): This variable captures whether the intervener attempted to affect the domestic/foreign policies of the target state.

Social protective intervention (social_protective): This variable captures whether the intervener attempted to protect a social group or minority population in the target state.

Pursuit across border (pursuit_border): This variable captures whether the intervener pursued a rebel/terrorist group across the border of the target state.

Economic protection (economic): This variable captures whether the intervener acted to protect its economic interests.

Strategic interests (strategic): This variable captures the strategic interests of the intervener, such as power balances, stability or ideological issues.

Humanitarian interests (humanitarian): This variable captures whether the intervention was a humanitarian mission to provide relief or protect lives.

Military and diplomatic interests (militarydiplomatic): This variable captures whether military or diplomatic interests were at stake.

Territorial interests (territorial): This variable captures whether the intervener's territorial interests were at stake, such as protecting territory, acquiring territory or resolving border disputes.

Contiguous states (contiguity): This variable captures whether the conflicting states were contiguous geographically.

Each of these variables above could explain why a state chooses to select into an air campaign. In the cases where the PGM capabilities of the coercing state far outweigh those of the target state, certain factors could still lead a target state to select into a campaign it has little hope of winning. Protecting its territorial integrity, strategic interests or ethnic populations could prove a strong enough incentive to select into a potentially losing campaign. Conversely, some states may select out of a campaign to protect those same interests. If the coercing state has overwhelming superiority in air force technology, the costs of losing power could outweigh the costs to other state interests.

3.5 Selection Model: All Cases 1917-2003

The duration selection model indicates that the accuracy effects are weakened in significance ($p=0.106$), but the sign remains positive. Table 3.6 annotates these results as well as the significant factors in the IMI data that could lead to the target state selecting into the air campaign. Selection into the air campaign is significantly associated with the presence of troops in the disputed territory (source), direction of intervener supporting action (direction), troop activity (type), and naval presence (naval). Additionally, the goals of the intervener play a role in selection; whether it is to affect the policies of the target state, intervene in a domestic dispute, or to protect economic or strategic interests

of the intervener. In light of the duration selection for all cases, accuracy is positive, but only significant at the 0.1 level.

Table 3.6: Duration Selection: All Cases 1917-2003

Hazard Interpretation (beta*p)

Weibull duration model with selection

Number of obs = 1141

Wald chi2(14) = 62.82

Prob > chi2 = 0.0000

Log pseudolikelihood = -334.46648

	Coeff.	Std. Err.	Z	P>[z]	95% Conf. Int.	
<i>Air2</i>						
Source	0.049	0.038	1.28	0.201	-0.026	0.124
Direction	0.118	0.027	4.37	0.000***	0.065	0.171
Type	0.062	0.025	2.41	0.016**	0.011	0.113
Naval	0.036	0.013	2.79	0.005***	0.011	0.061
Domestic Dispute	-0.034	0.020	-1.68	0.093	-0.073	0.006
Affect Policies	0.111	0.041	2.71	0.007***	0.031	0.192
Social Protective	-0.044	0.019	-2.37	0.018**	-0.081	-0.008
Pursuit Border	0.009	0.024	0.39	0.696	-0.037	0.056
Economic	-0.052	0.018	-2.84	0.005***	-0.089	-0.016
Strategic	-0.069	0.014	-4.92	0.000***	-0.096	-0.041
Humanitarian	0.008	0.021	0.38	0.700	-0.034	0.050
Territorial	-0.007	0.021	-0.36	0.722	-0.048	0.033
Militarydiplomatic	0.008	0.014	0.57	0.568	-0.019	0.035
Contiguity	-0.194	0.117	-1.65	0.098*	-0.424	0.036
Constant	-1.61	0.131	-12.27	0.000	-1.863	-1.350
<i>Months</i>						
Accuracy	0.0002	0.0001	1.62	0.106*	-0.00005	0.0005
Constant	-2.481	0.309	-8.02	0.000	-3.088	-1.875
Z_alpha	-0.536	0.159	-3.38	0.001	-0.846	-0.226
alpha	-0.490	0.120	-4.07	0.000	-0.690	-0.222
rho	-0.122	0.030	-4.07	0.000	-0.172	-0.055
ln_p	-0.352	0.072	-4.92	0.000	-0.492	-0.211
p	0.703	0.050	13.98	0.000	0.611	0.809

Significance Levels: *0.10, **0.05, ***0.01

Recall in the original Cox duration analyses, accuracy was only significant in the air campaigns after the introduction of PGM's (post-1970). An analysis of the selection effects on these cases is necessary to lend robustness to the findings.

3.6 Selection Model: Post-1970 Cases

Due to the fewer number of cases (N=24) in the post-1970 data, the greater variation in the accuracy values resembled a non-continuous variable hampering the ability to run the selection model. To address this shortcoming, I created an interaction variable (accuracy_1970) by multiplying the accuracy variable by the post1970 variable. I then ran a linear combination of these two to discern the effects of accuracy after considering the selection effects of only the post1970 cases.

The linear combination method revealed that the accuracy coefficient in the post1970 cases is positive (0.014) and significant at the 0.001 level. There was very little change in the selection factors from the IMI dataset, as the same factors remained significant at previous levels, with one exception. Contiguity of the combatting states became insignificant in the post1970 cases. It is speculative but logical to assume that the advent of global strike capabilities of states wielding precision weapons may have overcome the contiguity issue in the past. Air campaigns became easier to fight against states in distant regions of the world (Vietnam, Iraq (1991), Kosovo, Afghanistan, and Iraq (2003)) as aerial refueling and aircraft carrier strikes enabled campaigns against states that otherwise would have been inaccessible. Results are shown in Table 5A:

Table 3.7: Duration Selection: Post-1970 Cases

Hazard Interpretation (beta*p)

Weibull duration model with selection

Number of obs = 1141

Wald chi2(14) = 67.62

Prob > chi2 = 0.0000

Log pseudolikelihood = -326.15513

	Coeff.	Std. Err.	Z	P>[z]	95% Conf. Int.	
<i>Air2</i>						
Source	0.047	0.036	1.3	0.195	-0.024	0.119
Direction	0.116	0.026	4.5	0.000***	0.066	0.167
Type	0.06	0.025	2.37	0.018**	0.01	0.11
Naval	0.034	0.012	2.71	0.007***	0.009	0.059
Domestic Dispute	-0.033	0.020	-1.66	0.097	-0.072	0.006
Affect Policies	0.110	0.040	2.69	0.007***	0.030	0.189
Social Protective	-0.042	0.019	-2.28	0.022**	-0.079	-0.006
Pursuit Border	0.008	0.023	0.36	0.716	-0.037	0.054
Economic	-0.051	0.018	-2.86	0.004***	-0.086	-0.016
Strategic	-0.067	0.014	-4.95	0.000***	-0.094	-0.041
Humanitarian	0.008	0.021	0.38	0.705	-0.033	0.049
Territorial	-0.008	0.020	-0.38	0.701	-0.047	0.032
Militarydiplomatic	0.007	0.013	0.54	0.586	-0.019	0.034
Contiguity	-0.186	0.114	-1.62	0.105	-0.410	0.039
Constant	-1.59	0.130	-12.22	0.000	-1.847	-1.336
<i>Months</i>						
Accuracy	-0.0007	0.00012	-0.62	0.533	-0.0003	0.0002
Post1970	-3.762	1.131	-3.33	0.001	-5.978	-1.546
Accuracy_1970	0.002	0.0004	3.78	0.000	0.0007	0.0023
Constant	-1.012	0.203	-5.00	0.000	-1.41	-0.616
Z_alpha	7.15	0.202	35.41	0.000	6.76	7.55
alpha	0.999	4.9e-07	2.0e+06	0.000	0.999	0.999
rho	0.25	1.2e-07	2.0e+06	0.000	0.25	0.25
ln_p	-0.527	0.086	-6.15	0.000	-0.695	-0.359
p	0.590	0.050	11.66	0.000	0.498	0.698
Lincom (accuracy post 1970)	0.0014	0.00037	3.86	0.000***	0.0007	0.0022

Significance Levels: *0.10, **0.05, ***0.01

3.7 Conclusion

These findings support the hypothesis that the increased use of PGMs result in shorter and successful aerial bombing campaigns, however slight. While previous research emphasizes the military vulnerability of the target state as the contributing factor (Pape, 1996; Horowitz and Reiter, 2001), it can be argued that PGMs enable the faster increase of military vulnerability. These findings do not contradict this previous finding, but it does add a more robust measurement of military capability in such campaigns. As long as the most critical targets are identified and struck, the use of PGMs are justifiably a more attractive policy option for decision makers seeking to realize foreign policy objectives; however, this may hold true only in cases where there is a strong expectation that the war will be successful. PGMs, therefore, are not a panacea to all potential conflicts, but only those that present themselves as opportunities to achieve a quick victory. In such cases, PGMs can accelerate the realization of some of the previously found significant factors (vulnerability to denial/democratic attacker), but only if there is a possibility for PGMs to exploit them. Rolling Thunder (1965-1968) could have failed by the lack of precision, or it could have failed by a lack of identifying the proper targets that would collapse the North Vietnamese military strategy.

It is important to note that simply replacing the munitions employed without pursuing the appropriate strategy would unlikely alter the result of any given air campaign; however, if the proper targets were identified, it would be easier to destroy them quickly with PGMs. There may be an interaction effect between accuracy and vulnerability to denial, accuracy may increase, but unless it targets the appropriate mechanisms that reduce the target's vulnerability, it is unlikely to result in a shorter

campaign. This seems apparent in the lack of significance throughout failed campaigns, but more nuanced research is needed to gauge its robustness.

As I note above, selection effects work against the hypothesis that lower CEP reduces campaign duration, and the CEP variable weakens slightly to insignificance. Seeing that most states (Iraq, Afghanistan, Libya, and Serbia) that selected into air campaigns against western powers could not reasonably have expected to withstand the physical destruction of a precise air campaign, they choose to engage anyway. There is an opportunity here to investigate qualitatively why these decisions were made by target state leaders, and discern why they would risk the costs associated with an attack. I will address specific cases in a later chapter.

Finally, these findings are preliminary and exploratory, and they would benefit greatly from the refinement of the accuracy measure. Specifically, it would be helpful to weight each air campaign with the percentage of precision munitions employed as a fraction of the whole. Vietnam may have used PGMs, but they represented less than 10% of all munitions employed. As the proportion of PGMs increased, there may be a stronger and more significant effect. Additionally, there is a strategic interaction between the attacker's decision makers and military leaders, as well as the key players in the target regime. Case studies on the prominent air campaigns can help highlight these nuances, particularly the decisions and considerations made as each player observed and reacted to the decisions made by their opponents.

Chapter 4

Operations Rolling Thunder and Linebacker I/II

4.1 Introduction

This case study evaluates the role PGM's played in the success and failure of Operations Rolling Thunder and Linebacker I/II during the Vietnam conflict. Empirical findings in this research have thus far indicated that the more precise the weapons employed, the shorter the air campaign tends to be. The origins of PGM employment lay at the feet of the Vietnam War, where their development first took hold in 1972 as a solution to the decades-long problem the U.S. Air Force faced in assuring the adequate destruction of critical targets with minimal risks to aircrews. World War II introduced the theory of strategic bombing, but the technology lagged behind the theory. Technological limitations of the time prevented the level of precision the early airpower theorists envisioned. The Johnson administration in 1965 attempted to use strategic bombing in a limited fashion with catastrophic results for U.S. policy (Operation Rolling Thunder, 1965-1968). By 1972, the Nixon administration enjoyed greater success in coercing the North Vietnamese, as the nature of the war changed, and the introduction of precision weapons first occurred.

These military advances, and their impact on foreign relations, are essential for the international relations scholar to understand; as history shows, coercive bombing is becoming more frequent, and the costs of war to political decisions makers may be sufficiently reduced to make such military use a more attractive policy option. The ramifications to protection of U.S. national interests can be staggering, as U.S. military

might gains the ability to reach into the farthest corners of the earth to conduct devastating air attacks with relative impunity. There are three main reasons that precision air campaigns affect the decisions of political leaders, and each will be addressed in turn below. 1) Precision airpower reduces the costs of the military action itself by reducing the need for ground troops; 2) the act of war is becoming more normalized as Congress has ceased to actually declare it, as the instances of applied air power increases; and 3) the sanitization of warfare reduces the collateral damage to target-state populations and the number of U.S. casualties, both helping to soften the dangers of the political backlash of constituencies.

The Kosovo war was unique (as compared to the recent wars in Iraq and Afghanistan) in that the campaign was a success despite the fact that no ground troops were needed to coerce the Milosevic regime. This achievement led many in the airpower community to vindicate the earliest theorists in their assertions that airpower alone can win wars (Mitchell, 1925; Douhet, 1932). The technological foundations for the Kosovo war, however, took decades to develop and perfect. Desert Storm (1991) highlighted to the world the potential these new capabilities provided to future policy makers. Stealth technology, integrated communications and command and control, and the further refinement of precision munitions enabled the coalition air forces to virtually decimate the majority of the Iraqi occupation forces in Kuwait before a single ground troop was ever introduced. The air forces prepared the battle-space in such a manner that the coalition ground forces were able to defeat the world's third largest army and liberate an occupied state in a matter of weeks, all at the cost of only 148 battle fatalities.

The Gulf War air strategy was born out of the lessons-learned from the prior conflict in Vietnam. Specifically, that war's air campaigns laid the groundwork for the development and operational employment of precision guided munitions. The 1960's doctrine of gradual escalation was abandoned in favor of a massive aerial attack on all the critical nodes of the adversary's political, industrial and military structures. The result was not a serial sequencing from one target to another in an effort to inflict gradual harm on the enemy, but one of a parallel targeting of all key war-making enablers of the target state in one massive fell-swoop. The result was a paralyzing and crippling blow to the Iraqi leadership's ability to communicate with, command and marshal its forces in the field. Additionally, the overwhelming firepower of the air campaign drove hundreds of thousands of Iraqi soldiers to simply surrender on the battlefield at the first sight of ground troops (some actually attempted to surrender to aircraft flying overhead, as others surrendered to reporters advancing in the wake of the ground forces). Despite the success of the Gulf War, it is interesting that only eight percent of all munitions dropped were precision guided (Gillespie, 2006), but despite this low yield they were predominantly used to destroy key communication headquarters, the military and political leadership, and targets that required precision to minimize civilian casualties. The most essential targets were relegated to precision munitions, even if they were not used in such abundance as the subsequent war in Kosovo.

In addition to the advances in technology that enable such warfare, the mere act of war is being normalized. The United States has not declared war since World War II, yet it has employed military forces across the globe in ever increasing instances. Korea (1950), Vietnam (1965-1973), Grenada (1983), Panama (1989), Libya (1986 and 2011),

Iraq (1991 thru 2003), Somalia (1993), Bosnia and Kosovo (1995 and 1999) and Afghanistan (2001) are just the more prominent operations. Mounting international pressures, with a focus on human rights, are constantly calling on intervention to stop genocides, ethnic cleansings and civil wars. All these foreign policy challenges confront decision makers, and in the crucible of debate, military capabilities are weighed in determining whether or not to intervene. As recently as 2011, President Obama decided to commit to a NATO operation to oust Muammar Gaddafi from Libya in a series of airstrikes to aid the rebels' attempt to overthrow the regime. U.S. contributions consisted mainly of strike aircraft, pilotless drones and intelligence services to the allies. Conversely, when asked about intervention in Syria, the Chairman of the Joint Chiefs of Staff ruled out military intervention because the risk was too high to U.S. servicemen and the threat of a Middle Eastern escalation.

In the United States, the public opinion plays significantly into decisions on whether or not to employ military force. The Congress alone is authorized to declare war, and in so doing, representatives must weigh the costs in American lives against the objectives to be attained. There is abundant literature that attempts to explain why democracies generally do not fight one another, as well as how they fight wars when they choose to engage in them. First, democracies do fight wars, albeit more often with non-democracies than democracies (Maoz and Abdolali, 1989). Secondly, when democracies do fight, they tend to win more often than non-democracies (Lake, 1992; Reiter and Stam, 1998). Third, democracies are more likely to start wars against autocracies than the reverse (Bennett and Stam, 1988). Fourth, larger democracies experience more constraints to avoid war than smaller democracies (Morgan and Campbell, 1991). Finally,

democracies are more likely to shift resources into a war since larger winning coalitions (necessary for political support) hinges on successful waging of the war (Bueno de Mesquita, et al, 1999). These findings suggest that democracies conduct a cost-benefit analysis that answers the question, “what is intervention worth, and how much will it cost?” The advent of PGM technology helps to mitigate the costs often associated with waging war, and it is logical to suggest that these capabilities play into the decisions to employ force. The Johnson administration during the Vietnam conflict assumed that brief periods of gradually escalating bombing would coerce the Hanoi government into negotiating a peace that halted the communist insurgency in the south and maintained a democratic government in Saigon (Karnow, 1983). This course of action was greatly influenced by gradual escalation theory of Thomas Schelling (1966); but the bombing campaign failed to meet its objectives from 1965-1968, and the Johnson administration became so embattled with its constituency over the growing failure that the President declined to seek re-election (Karnow, 1983). Would the employment of PGM’s have made a difference during the air campaign (Rolling Thunder) Johnson waged with such high hopes for success? While the benefits of PGM’s may have reduced the number of U.S. airmen casualties, mitigated the amount of collateral damage to the Vietnamese civilian population, and required less financial expense by reducing the numbers of forces required, this case study argues that “no,” the employment of PGM’s would not have altered the outcome as the North Vietnamese were not waging a war vulnerable to air strikes. The strategy the Johnson administration employed was fighting the wrong type of war where it could have been effective.

There was a significant shift in North Vietnam's strategy, however, in 1972 when the Nixon administration took over prosecution of the war. The Hanoi government transitioned the guerilla war to a conventional war beginning with the Easter Offensive in 1972, and saw the introduction of PGM's into the campaign. This shift has been credited with allowing the U.S. air campaign to fight North Vietnam in the open against conventional military targets such as troop concentrations, supply depots, and armored forces (Clodfelter, 1995). Hanoi increased its vulnerability to denial by launching a conventional offensive reliant upon conventional tactics, forces and the means to supply them (Pape, 1996; Clodfelter, 1995), and U.S. airpower was able to strike targets decisively destroying them (with PGM's) to such an extent that Hanoi's ability to counter-escalate was virtually wiped out (Byman, Waxman, and Larsen, 1999). In terms of the larger theory, Nixon was presented with an "opportunity" (Most and Starr, 1989; Fordham, 2004) to exploit the change in Vietnamese strategy; enemy forces were now in the open, were more vulnerable to air strikes, and the American public was anxious to extricate the country from the war (Karnow, 1983). Nixon also indicated a stronger "willingness" (Most and Starr, 1989; Fordham, 2004) to prosecute the air campaign much more aggressively in 1972. Precision weapons, available for the first time, increased the effectiveness of strikes, reduced collateral damage, and increased aircrew survivability (Cohen, 2004), thus providing Nixon with the tools his predecessor did not have. These advanced capabilities have also been found to strengthen the hand of hard-liner politicians who are more willing to use military force (Fordham, 2004). Nixon's approach to the air campaign in Vietnam was an intense escalation, much more aggressive than the gradual escalation policy of Johnson.

Effective air campaigns can also act to make war more remote to the public.

Advances in modern weaponry coupled with the rudimentary military capacities of second- and third-world states, has reduced the risk to U.S. military forces thus lowering the expected costs of military intervention. This environment runs the risk of insulating the American public from the realities of war (Ignatieff, 1999), and many observers have called upon the government to return to the constitutional declarations of war (Summers, 1982), as opposed to merely voting to “authorize the use of force.” The War Powers Act gives the executive free reign to employ forces anywhere for up to ninety days. The intent behind the act was to limit executive power to commit the nation’s military; if the ninety days elapsed and the Congress did not declare war, the troops are to be sent home lest the Congress cut off funding. Once committed, however, Congressmen would be committing political suicide to abandon troops engaged on the battlefield. Under these circumstances, advances in weaponry have enabled politicians to side-step the consequences of war. Absent the detractors of dead soldiers returning home in mass, the lack of conscription and resource rationing at home and the increasingly absent elite from the armed forces all combine to make the realities of war extremely remote to the American people.

While the Vietnam air campaigns from 1965-1972 provide an example of how a shift in technology can facilitate a change in the military and political strategies used to achieve a state’s objectives in the conflict, there is a downside to the types of adversaries who may select into the conflict. The increased technology can create such a gap in capabilities that only relatively resolved states will choose to confront the coercer (Fearon, 1994). Even prior to the advent of PGM’s, the United States possessed a far

superior capabilities advantage over the North Vietnamese, yet Hanoi possessed the resolve to fight. In doing so, the North Vietnamese essentially negated their technological inferiority by adopting an irregular-war strategy that reduced their vulnerability to U.S. air attacks (Pape, 1996). In essence, greater military capabilities of the coercing state can be a double edged sword. On the one hand, an out-matched target state uncommitted to a guerilla war would not opt into the conflict. On the other hand, one that is committed to waging an irregular war would opt into the conflict using a strategy that mitigates the technological advantages of the coercer. Hanoi adopted this latter strategy from 1965-1968 during Operation Rolling Thunder, and they largely succeeded against the U.S.; however, when they shifted to a conventional conflict in 1972, U.S. advantages were realized thus leading to Hanoi's capitulation.

PGM technology can be decisive in air campaigns, but this case study argues that these advantages only bear success when applied in the correct context. The type of war being fought must suit the military advantages a state possesses. Misapplication of precision technology can still result in a failed war, even though PGM's typically reduce their duration. Next, I will explain why Vietnam represents an excellent example of this misapplication from 1965-1968 as well as how PGM's affected the successful conclusion of the 1972 campaign.

4.2 Case Study Selection

I have chosen two air campaigns, Operations Rolling Thunder and Linebacker I/II, during the Vietnam War to evaluate the role precision guided munitions (PGMs) played in the effectiveness of both campaigns. I chose these two cases because the

transition between the two marked a significant shift to the use of PGM's. Secondly, this shift occurred during the same conflict which can hold constant many (admittedly not all) influential factors that can vary across different conflicts (terrain, manpower, preparedness of forces, regime types, etc.). In addition, the goals of both combatants remained relatively the same, specifically the strategies and operational objectives. The most significant variation occurred in weapons capabilities and employment.

PGM's played no role during the Rolling Thunder campaign, but this case study concludes that even had they been available, the conventional air strategy applied to a non-conventional (guerilla) adversary would have been just as ineffective. Once the war transitioned to a conventional campaign, PGM's likely made the campaign winnable. The analysis that the key to U.S. success was the transition from a guerilla to a conventional war is not new, nor controversial. This case study does not seek to add anything new to the historical timeline of events. The aim rather, is to highlight the role PGM's played in both time periods to evaluate their efficacy in overcoming adversary capabilities and successfully coercing an opponent to concessions. This case study concludes that PGM technology in Vietnam enabled success, as long as the correct strategy for victory is adopted. Technology in the Vietnam War was not a panacea for bad strategy and poor execution.

4.3 Technological Capabilities and Limitations

The Rolling Thunder campaign air forces were poorly equipped to conduct highly precise bombing on discreet targets of personnel, bridges, and vehicle columns. The objective was to diminish the North's ability to wage a guerilla war, but the technology

simply did not exist to achieve such results. In the aftermath of World War II, U.S. airmen and aircraft were trained and designed to deliver tactical nuclear weapons where precision was not a high priority. The Vietnam War introduced a steep learning curve to design new methods and technologies to strike individual targets with precision. One example of these limitations was the attempt to destroy the Thanh Hoa bridge. Existing tactics dictated that aircraft would conduct radar bombing runs, where the target was identified by radar and bombs were released ballistically; that is the pilot (and aircraft's computer) would compute a bomb release point based on altitude, airspeed, and wind direction (Gillespie, 2006). The bomb would thus "freefall" to its target, and its accuracy was a factor of proper computations and accurate knowledge of the atmospheric conditions. This targeting system was expected to place a bomb within 2,000 feet of the intended target, and while this margin of error was sufficient for a nuclear weapon, it was inadequate for discreet point targets. Targets were selected, therefore, on the basis that they could be destroyed, not necessarily on their critical nature (Lambeth, 2000). In order to identify the target by radar, it had to have salient features that facilitated the systems employed. The bombs may be able to hit a bridge, but the bridge itself may not be critical to achieving the strategic objectives. The Thanh Hoa bridge was initially attacked by 46 aircraft with no discernible damage reported (Corum, et. al., 1978). Exacerbating the poor accuracy was the low yield of initial munitions, the bombs were simply too small to affect appreciable damage. As one analysis described it, attacking the bridge "was about as effective as shooting B-B's at a Sherman tank" (Lambeth, 2000). A need for more powerful bombs emerged that was not realized until the Linebacker operation.

The lack of accuracy, inappropriate doctrinal concepts (nuclear focus), and inadequate bomb yield were remedied in 1972 with the introduction of the first PGMs. Electro-optically steered bombs introduced steering fins controlled by a television tracking camera (Lambeth, 2000). These new capabilities enabled the air forces to drop the Thanh Hoa bridge in one mission, and on another mission 65 out of 68 bombs scored direct hits (Lambeth, 2000). Electro-optically guided munitions were limited, however, in that they required an unobscured line of sight to function. These weapons could not “see” through smoke or cloud cover and weather often precluded their employment. These limitations were overcome in 1972 with the introduction of laser-guided bombs, and it was with these weapons that a mere four aircraft were able to destroy the bridges as opposed to the 46 aircraft that had failed earlier.

Technological advances undoubtedly improved the air forces ability to destroy the intended targets, and targeting was no longer a function of the mere ability to strike it. Rolling Thunder is often characterized as a campaign that struck the wrong targets to achieve the desired effects and suffered unacceptable losses (nearly 1,000 aircraft were lost in that campaign), but while this description is accurate, it could largely be a product of the technological limitations of the time. While a guerilla campaign does require striking different targets than a conventional one, Rolling Thunder could have been successful had the air forces possessed the capability to strike discreet targets. The campaign against bridges is a prime example of how low precision bombs could damage the bridge they could not specifically hit the critical elements such as the pilings and supports. This gave the Vietnamese the opportunity to quickly repair the damaged superstructure, whereas in Linebacker (and with PGMs) the bridge supports themselves

could be destroyed, thus making repairs lengthy if not impossible. The objectives of Rolling Thunder outpaced the technological capability available to the air forces, and once these limitations were overcome, effectiveness increased dramatically. Today's air campaign in Iraq and Afghanistan are capable of disrupting dispersed terrorist networks by identifying, tracking, targeting and striking targets down to the individual vehicle or insurgent. The objectives can be obtained with the available technology, and air forces have largely overcome the targeting limits present in Vietnam.

4.4 Strategic and Political Objectives

The Vietnam War was fought within the context of the Cold War's containment policy. This policy sought to contain the spread of communism throughout the world without instigating a direct confrontation with the Soviet Union. As the democratic state of South Vietnam came under threat of North Vietnamese communism, the Johnson administration sought to prevent this spread south via a coercive bombing campaign. The objective was to force Hanoi to cease supporting the insurgency in the south (the Vietcong) and to enter serious negotiations to establish a lasting peace (Pape, 1996). The bombing campaigns were designed to bring about changes in the North's behavior, but it appeared muddled in the initial days. In the early stages of the war, there were no calls from the Johnson administration to halt bombing and remove troops as a response to parallel North Vietnamese concessions, rather the strategic debate raged over the intensity of the bombing campaign (Karnow, 1983). The two camps competed over whether the bombing would be an all-out military effort of overwhelming force or a

graduated escalation in response to Hanoi concessions. These two camps were not divided, however, between the military leaders and the civilian politicians. Advocates of the overwhelming bombing campaign comprised the top military leaders, but Walt Rostow (State Department planning director), Dean Rusk and the CIA also advocated such an approach (Karnow, 1983). Those who advocated the graduated response were led by Secretary of Defense Robert McNamara, Secretary of State Averill Harriman, some CIA analysts and lower level generals in the field (Karnow, 1983). This latter view was heavily influenced by the political scientist Thomas Schelling's theory of managing risk by steadily increasing bombing pressure as a threat against North Vietnam (Schelling, 1966). In this vein, the threat of future attacks would increase the risk to the North to such an extent that it would capitulate to U.S. demands. To prosecute an overwhelming air campaign that destroyed all the targets at once would undermine this approach by "killing the hostage," thus signaling to Hanoi that concessions would be futile because there would be nothing left to negotiate with. The objectives of limited war were simply inconsistent with the military's strategy of waging a campaign of overwhelming force.

By 1967, the results of the Rolling Thunder campaign were becoming dismally evident. A CIA summary of the air strikes concluded that hundreds of bridges were destroyed, but many had been rebuilt or bypassed; thousands of trucks and logistics vehicles were destroyed but the North was still moving supplies unencumbered; three quarters of the country's fuel supplies had been destroyed but there were no fuel shortages; it cost the U.S. ten dollars for every dollar of destruction; and the morale of the Communists had not been weakened as expected (Karnow, 1983). The military response was to increase the bombing, "...bomb, bomb, bomb...that's all they know," Johnson

complained, and when General Westmoreland (Commanding General in Vietnam) returned home in 1967 warned that the “war would go on indefinitely” if the U.S. could not find a way to “halt North Vietnamese infiltration” (Karnow, 1983). Westmoreland wanted more ground troops. Despite these dismal results, however, Johnson was faced with the specter of inducing the Chinese into the fight if he increased the pressure, “I’m not going to spit in the Chinese’s faces” (Johnson, in Karnow, 1983). Alain Enthoven (a senior assistant to McNamara) summed up the quandary thus: the real force facing the world today was “less communism than nationalism,” and American bombing would not “hurt them so badly as to destroy their society...or their hope of conquering Vietnam” (Enthoven, in Karnow, 1983).

Rolling Thunder identified 242 targets that needed to be destroyed to compel the North to concede, and from 1965-1968 these targets were successfully destroyed without the desired political outcome (Clodfelter, 1995). Since the North was waging a guerilla war, the targets selected were not critical to Hanoi’s strategy. The destruction of transportation, military, and industrial targets did not hamper the North’s insurgent strategy because the insurgents simply didn’t need them, rather they relied upon low levels of logistics and support from the indigenous populations within which they moved. U.S. air forces were organized, trained and equipped to fight conventional, not irregular, wars. Ground commanders recognized the need to isolate the Viet Cong from the southern populations in order to delegitimize their cause and convince the south that they could defy the communists. Airpower did not have the capability to conduct such low-intensity and surgical air strikes to accomplish this task. The weapons used were not precision-guided, and aerial missions usually caused more harm to innocent civilians than

the Viet Cong. Casualties were mounting among civilian populations as bombs went astray, failed to hit their targets, or adequately destroy them when they did. Additionally, the U.S. was losing hundreds of aircraft and pilots, thus taking its toll on constituency support back home. Johnson's political advisors went to great lengths to minimize civilian casualties and placed restrictions on theater commanders that minimized the amount of damage that could be inflicted on the North (Pape, 1996). PGMs could have provided the ability to destroy these targets without such large civilian casualties, thus increasing the effectiveness of the campaign. For example, during Rolling Thunder bridges had to be struck multiple times with large formations of aircraft to render them ineffective, but the damage was not overwhelming enough to deter the North Vietnamese from rebuilding them. Subsequent strikes were launched, more bombs were dropped, more aircraft lost, and more airmen killed or captured for an unrealized payoff. Once such bridge was the Paul Doumer, which was struck repeatedly from 1965-1968 with no success, but in 1972 the same bridge was struck with PGMs. The bridge was brought down so decisively that the long sought after effects were achieved, all with relatively little losses in men and material. Finally, the conventional shift by the North created a need for a large logistic supply train to ensure availability of ammunition, food, fuel, and mobility. Airstrikes on these highly vulnerable and critical targets led to Hanoi's eventual capitulation and a return to negotiations. While this shift in military strategy played a large role in U.S. success, it would have been for naught had the air forces been unable to strike them effectively, and PGMs certainly facilitated this success.

The political and strategic objectives of the Linebacker campaigns differed significantly than those of Rolling Thunder. Richard Nixon was the new president in the

U.S., and his challenge was to respond to an outright North Vietnamese invasion of the South. Hanoi's objective from the start had been to unify the two countries into one communist Vietnam. 3 years of Vietnamization had been underway since Nixon came to power; a significant drawdown of troops and aircraft was the means to transfer security to the South. Hanoi took advantage of this drawdown by launching an invasion in March, 1972. Nixon's response was drastically different than Johnson's, in that he launched the most intensive interdiction air campaign to date against the North's war-making capability. Instead of conducting attacks on an amorphous counter-insurgency (as Johnson faced), Nixon was facing an all-out conventional war, one that the U.S. Air Forces were well equipped and trained to fight. The political outcome sought by Nixon was a face-saving way for the U.S. to withdraw while maintaining an intact South Vietnam. Negotiations were conducted with Hanoi as the bombings continued, eventually leading to an agreement in October; however, the Saigon refused to endorse it. Nixon responded once again with bombing, but with a different objective. Linebacker I broke the capability of the North to wage war, Linebacker II targeted the will to fight.

4.5 Operation Rolling Thunder (1965-1968)

Rolling Thunder commenced on 2 March 1965 and terminated on 31 October 1968. Its goals were twofold: first, the campaign sought to stop the North Vietnamese infiltration into the south, and secondly, to bring the North Vietnamese government to the negotiation table to construct a peace (Pape, 1996). There were three competing strategies regarding the employment of airpower, and all three were employed over three years of

bombing with no success. The first strategy emanated from the influential writings of Thomas Schelling (1966) advocating a costs-risks campaign through gradual escalation, and it was this strategy that Johnson's civilian advisors adopted (Pape, 1996). The idea behind this strategy is to inflict enough damage on the target state's industry and social fabric without completely destroying it; the costs of future escalation should carry enough risks to coerce the target government to concede (Schelling, 1966). The second strategy centered on the civilian population, and it was advocated by the U.S. Air Force (Pape, 1996). While not intending to attack the civilian populations directly, the Air Force sought to destroy the industrial base quickly without the gradual escalation advocated by the administration (Pape, 1996). Raising the short-term costs to unacceptable levels was seen here as the best way to restart negotiations, not relying a future threat of escalation that would essentially accomplish the same outcome. Finally, the Army advocated a military denial strategy in which the military vulnerabilities of North Vietnam would be exploited and destroyed (Pape, 1996).

As the result of a Viet Cong attack on American personnel at Qui Nhon, President Lyndon Johnson authorized the first air attacks on 2 March 1965 against a North Vietnamese naval base at Quang Khe (Lambeth, 2000). Thus began a three year air campaign directed at weakening North Vietnamese resolve to continue their unification campaign with South Vietnam. In the end, the air operation would drop 643,000 tons of bombs, destroying 65% of the North's oil storage capacity, 59% of its power generating facilities, 55% of its bridges, nearly 10,000 vehicles and 2,000 rail cars (Clodfelter, 1995). The targeting choices indicate that the strategy sought to destroy and disrupt North Vietnam's ability to supply and transport needed war materials to the insurgent Viet

Cong operating in the south. Consistent with the stated U.S. goals of forcing a withdrawal of the Viet Cong, a cessation of North Vietnamese support for the Viet Cong, and the establishment of a democratic and stable South Vietnamese government, Rolling Thunder was designed to inflict a gradually escalating bombing campaign. North Vietnam would have the opportunity to re-evaluate its stance during the subsequent 8 bombing pauses (Clodfelter, 1995), and then decide whether to meet U.S. demands or to continue infiltration and support for the insurgency. History shows, that the North chose the latter following every halt from 1965-1968.

The scholarship that emerged after the war in evaluating Rolling Thunder's effectiveness in attaining its goals coalesced into a consensus that the interdiction campaign against the North's capacity to re-supply the Viet Cong insurgency failed for two reasons: the guerilla war being waged was not vulnerable to a conventional air attack and secondly, disruption of its logistics could easily be compensated by rapid replacement and repair of damaged infrastructure (Lambeth, 2000; Clodfelter, 1995; Pape, 1996). The following narrative will trace the evolving nature and goals of the Johnson administration in the context of air operations and attempt to explain how the absence of precision technology may have hampered these efforts. Three years of bombing and tens of thousands of combat missions presents a daunting task for this brief case study, however, Pape (1996) presents a general breakdown of the campaign in four distinct phases. This study will trace these four phases with special emphasis on the strategy, objectives, and effectiveness of each phase.

The first phase occurred during the spring and summer of 1965 where the U.S. air forces sought to gradually escalate the destruction of the industrial infrastructure of

the North (Pape, 1996). The intention behind this strategy was to eliminate or to curtail the North's ability to support the Viet Cong in the south and to threaten the regime itself with future attacks. Additionally, the campaign was designed to incrementally move from southern targets to the North, eventually creating the perception that if Hanoi did not concede to U.S. demands, that city itself would be under threat of air strikes. This strategy provided Hanoi with a critical asset to hold out against the U.S., time. By June 1965, the North was able to substantially build up its defenses around Hanoi, particularly in surface-to-air missiles (SAM's) and air defense fighter aircraft (Lambeth, 2000). This in effect negated the threat of future escalation proposed by the U.S. The Johnson administration consistently rebuffed U.S. military leaders' calls to attack these new SAM sites and the military airfields before they became operational, thus increasing the threat to U.S. aircraft (Lambeth, 2000). Johnson was additionally concerned that the presence of Chinese and Soviet personnel, who were advising the North Vietnamese on the construction efforts, increased the risk of attacking these targets; thus threatening to expand the war to these two countries should any of their personnel be killed in an air attack (Lambeth, 2000). Finally, the first phase strategy relied on strategic air doctrine developed and executed during World War II, one that was inappropriate under the present conditions. During that previous war, the allies were fighting industrial states reliant upon the production and transportation of massive amounts of war materiel. Strategic bombing attacks on oil refineries, munitions factories, and aircraft production facilities were more effective against an adversary whose very lifeblood resides in the industries. The Viet Cong, by contrast, did not rely upon a robust industrial infrastructure. Insurgent forces were able to survive by resupplying from local villages, and the

dispersed nature of guerilla warfare allowed the North to transport rifles and ammunition relatively undetected in the dense jungles of Southeast Asia. The air strategy was ill-suited to inflicting the required pain, and the threat of escalated pain, upon Hanoi or the insurgents in the south.

The second phase lasted from late summer 1965 through early 1967, where the U.S. focused on interdicting the supplies flowing into the south (Pape, 1996). 93% of all sorties were “armed-reconnaissance,” where attack aircraft roamed the skies looking for appropriate targets, while only 7% of all sorties targeted industry and infrastructure (Pape, 1996).

The third phase occurred during the spring and fall of 1967 when Johnson removed many of the political constraints on industrial targets located near Hanoi (Pape, 1996). The air campaign to date had bogged down into ineffectual interdiction of Viet Cong forces, and under pressure to achieve better results, Johnson decided to deliver an intense blow to the North by a concerted effort against Hanoi (Pape, 1996). Targets included electrical station, bridges, chemical plants, steel and cement production, and explosives manufacturing; by this time most of the industrial targets had been destroyed with no appreciable change in the North’s attitude (Pape, 1996).

The fourth phase covered April to November of 1968, and when public support finally turned against Johnson back home, the bombing de-escalated rapidly (Pape, 1996). The attacks were gradually rolled back from the Hanoi area and eventually stabilized in an effort to interdict Viet Cong resupply efforts near the demilitarized zone separating the North from the South (Pape, 1996). By December of 1968, aerial

bombardment of North Vietnam came to an end, after succeeding in destroying nearly all industrial targets without coercing Hanoi to concede to U.S. demands. Bombing would not resume until 1972 during the Nixon administration.

4.6 Why Coercion Failed in Rolling Thunder

The application of an ineffective strategy during Rolling Thunder led ultimately to its failure. The Johnson administration applied the Schelling escalation strategy to an adversary that was not reliant upon the critical targets identified in such a strategy. The presence of PGM's would have had very little effect on coercing Hanoi to concede.

While admittedly this conclusion is counter-factual, the evaluation of the advantages of PGM's can help shed light on what 'could have happened' had they been available. First, PGM's primary advantage is the ability to successfully strike a desired target. Rolling Thunder lacked this precision in the aircraft employed; therefore U.S. air forces had to dedicate larger numbers of aircraft against a given target to ensure its destruction.

Overall, the aircraft were able to destroy the desired industrial targets, but losses were high. Repeated attacks over the same targets allowed the Vietnamese defenses to engage the attackers multiple times, thus increasing the likelihood of shooting some down. Had precise weapons been available, losses could logically have been lowered, but the flawed strategy of attacking the industrial infrastructure of a non-industrial state would likely have not brought about the desired capitulation of Hanoi. Secondly, PGM precision mitigates the collateral damage incurred by attacking targets in highly populated areas. Electrical power grids and petroleum storage facilities are typically located in urban

areas, and Johnson was very sensitive to avoiding civilian casualties. PGM's could have lessened his fears, but the fact remains that the targeting strategy was still flawed. Finally, precision weapons cannot find the appropriate targets to attack; intelligence is required to locate a Viet Cong convoy or dispersed guerilla fighters. The nature of the war in the south precluded the identification and "fixing" of the appropriate guerilla forces to strike. Precision technology would not have added meaningful information to this constant challenge throughout the war. To support these conclusions, quantifiable data can better illustrate the shortcomings of an escalation strategy in Vietnam.

One goal of the air strategy concentrated on disrupting the logistical flow to communist insurgents operating in the south. The hope being that if the Viet Cong were 'starved' of firepower, fuel, and food, the insurgency could be crippled. This proved not to be the case. By 1967, regular North Vietnamese Army forces operating the south numbered only 55,000; while Viet Cong forces (those responsible for the insurgency) numbered 245,000 (Clodfelter, 1995). The Viet Cong were able to blend in with the local populations, thus minimizing their supply requirements from the North. Additionally, fighting between the Viet Cong and American ground forces occurred sporadically, giving the insurgents time to refit between battles, most of which they lost. The strategy of the Viet Cong was simply to wait out the American presence; to engage in continuous fighting would have been disastrous for the insurgents. The communists only needed 34 tons of supplies from outside the south to continue fighting, and this requirement represents less than 1% of the daily tonnage imported into North Vietnam (Clodfelter, 1995). Thus, the interdiction campaign waged in the North during the middle phases of

Rolling Thunder was successful at destroying the North's infrastructure, but did little to hamper the Viet Cong's ability to wage a guerilla war.

The strategy employed during Operation Rolling Thunder was flawed from its inception for one reason: the targets identified were not critical to the communist insurgency in the South. The over-arching U.S. objective from 1965 to 1968 was to defeat the communist insurgency in the South; however, the bombing campaign was predominately focused on the North's support for the insurgency. "Political and military controls prevented attacks against the only two targets that would have affected Northern war-making capacity: people and food" (Clodfelter, p. 140, 1995). Johnson was not politically prepared to wage such a campaign against the people of North Vietnam. Precision weapons would not have added appreciably to success had he decided to do so. Theoretically, if Johnson had the ability to precisely attack the regular North Vietnamese Army units and destroy the dikes and dams essential for the rice crops, the unintended consequences to the civilians who relied on food supplies would be devastating. Furthermore, the humanitarian disaster that would ultimately ensue would only bolster the increased supplies already flowing into the North from its allies China and the Soviet Union. Success in the South could not be achieved by a war in the North, despite what earlier air doctrinal lessons from World War II would suggest. The critical targets from 1965-1968 were in the South, specifically the Viet Cong insurgency. The strategy employed was simply misplaced and focused on doctrinal concepts of the past which did not apply to an insurgency. Operation Linebacker, however, experienced an entirely different set of circumstances that facilitated the use of industrial and military interdiction

to great effect. It is this operation, and the subsequent introduction of PGM's, that we be explored next.

4.7 Operation Linebacker (1972)

In March 1972, the North Vietnamese launched a conventional (not guerilla) offensive into the south, and in response the U.S. launched the Linebacker air campaign to defeat the communist forces, restart negotiations, and conclude a peace settlement. Linebacker I ran from 10 May to 23 October 1972. It succeeded in bringing the North Vietnamese back to the negotiating table, but the South Vietnam government balked at the talks, thus driving the North away from concessions (Pape, 1996). To coerce the North back to the table, the United States initiated Linebacker II, from 18 to 29 December 1972. The North returned to negotiations and a settlement was reached allowing the United States to disengage from the conflict. Scholars have attributed the success of this campaign due to the change in North Vietnamese strategy, specifically shifting to conventional conflict (Pape, 1996; Clodfelter, 1995; Cohen, 2002; Byman and Waxman, 2002). While this analysis is generally correct, I contend that the introduction of PGMs into the campaign played a significant role in the campaign's success. It is the purpose of this case study to discern that role.

The Rolling Thunder campaign failed mostly due to an incorrect identification of the appropriate strategy required to defeat the communist insurgency. The situation had changed by 1972 as Nixon now had at his disposal two new tools to bring the war to an

end; improved military capability and popular support to act more aggressively to bring the war to a conclusive end.

Linebacker I: May-October 1972

Operation Linebacker resumed bombing after Johnson had halted it for three years. In 1972, the Nixon administration faced a change in Hanoi's strategy as that country ceased guerilla operations and initiated a conventional ground offensive aimed at conquering the south and reunifying Vietnam. Nixon's objective was to counter this conventional military campaign by compelling the North to cease the ground offensive and accept a cease fire (Pape, 1996). To achieve these objectives, JCS Chairman Thomas Moorer advocated a three-pronged approach of 1) destroying the war material already in the North, 2) prevent the flow of this material to the South, and 3) interdict (destroy) the flow of troops and material to the south (Pape, 1996). This strategy would prove to be successful because the North had shifted to a conventional military campaign that was highly susceptible to air power. While the Rolling Thunder campaign had focused on civilian and economic targets, the Linebacker campaign targeted those elements that could directly hinder the North Vietnamese offensive (rail lines, fuel dumps, warehouses, bridges, and vehicles) (Pape, 1996). This campaign affected the North's ability to wage a conventional campaign, thus ultimately bringing them back to the negotiating table. But while the predominant literature cites this shift as the primary factor of success, it is plausible to conclude that the advances in military technology (employment of PGMs)

could have played a larger role that it is given credit for. It is this development that I will address next in the ability of the U.S. to achieve its objectives.

As U.S. President Nixon entered office, he began a policy of “Vietnamization” to eventually place South Vietnam in charge of its own defense against the North. Public support had evaporated in the U.S. for the war, and Nixon was searching for an honorable way out of the conflict. By early 1972, most of the U.S. Air Forces had been withdrawn from Vietnam as Nixon and Henry Kissinger conducted negotiations to guarantee a sovereign South and a halt to hostilities (Clodfelter, 1995). This all changed on 30 March, 1972 when North Vietnam launched a conventional military offensive into the South. Nixon responded by resorting to airpower to blunt the offensive, and by 13 May, U.S. air forces had returned to the region to initiate Operations Linebacker I/II (Clodfelter, 1995).

Linebacker I began on 10 May, 1972 as aircraft struck the Paul Doumer Bridge and the Yen Vien Railyard in Hanoi; the pilots dropped 29 new laser- and electro-optically guided “smart” bombs scoring significant damage on both targets (Clodfelter, 1995). The Paul Doumer Bridge had been subject to multiple attacks during 1965-1968, but it was capable of surviving all previous attacks until 1972. The key difference was the introduction of PGM technology into the conflict. Part of Johnson’s hesitation to attack key targets in heavily populated areas stemmed from fears of collateral damage to the civilian population. These new weapons were so accurate that Nixon’s more aggressive air campaign was able to strike these targets while minimizing civilian casualties. As one example illustrates, on 26 May, a flight of just a few strike aircraft attacked the Son Tay warehouse and storage area, three buildings measuring 300 x 260 feet, 260 x 145 feet, and 210 x 65 feet; just three bombs were dropped and successfully hit and destroyed all

three buildings (Clodfeletr, 1995). The campaign's targets remained those that significantly supported and enabled the North Vietnamese offensive into the South. Logistics centers, transportation infrastructure, and any other targets that directly fed men, ammunition and foodstuffs into the North's armies were struck with great effectiveness. The numbers of aircraft required dropped significantly from dozens during the late 1960's to an average of just 8 to 10 aircraft in a given strike package (Clodfelter, 1995). Precision allowed the discreet destruction of critical targets needed by a conventional offensive, but more importantly, the strategy adopted by U.S. air forces was conducive to the kind of war the North was fighting.

North Vietnam's strategy had always been a unified Vietnam under a central communist government, and with the drawdown of U.S. forces from 1969 to 1972, they felt the time was right to launch a conventional offensive to realize this goal. Nixon, engaged in peace talks to ensure a face-saving U.S. departure, responded aggressively to the invasion and was able to wage a much more intensive air campaign than Johnson. The targets chosen were the same types of targets during the Rolling Thunder campaign, but the key difference in 1972 was that the targets were much more critical now that the North was waging a conventional invasion. Had PGM's not been introduced, Nixon would have found himself in the same predicament as Johnson, how to strike key infrastructure targets without incurring unacceptable civilian losses. Higher precision of new weapons, and the identification of the correct strategy, enabled the Linebacker campaign to eventually halt the North's advances. By June, the North Vietnamese advance had sputtered, resulting in the resumption of peace talks. Despite the talks, the bombing continued. Sortie rates continued to increase until a peak in September when

111 PGM bomb sorties were flown by 7th Air Force alone; additionally, pilots were perfecting navigation procedures that enabled successful missions that previously would have been canceled due to bad weather (Clodfelter, 1995). By 13 October, precision missions flown by F-111 aircraft alone accounted for over half of all strike missions (Clodfelter, 1995).

The Linebacker I campaign dropped 155,548 tons of bombs on key infrastructure targets in North Vietnam, this is roughly one-fourth the tonnage dropped from 1965-1968 (Clodfelter, 1995). “More damage was done to the North Vietnamese lines of communication during Linebacker than during all our previous efforts” (General Vogt in Clodfelter, 1995). Smart bombs inflicted most of the damage: fifteen railroad bridges were destroyed, overland imports were reduced by 130,000 tons per month, mining the harbors reduced imports from the sea from 250,000 tons per month to near zero, most of the oil storage facilities were destroyed as well as 70% of all electricity generating capacity (Clodfelter, 1972). These devastating effects of the Linebacker campaign succeeded in the North abandoning its takeover of the South and restarted negotiations; however, these talks still failed to produce a lasting settlement throughout the fall of 1972, driving the resumption of bombing in December: Linebacker II.

Linebacker II: The Christmas Bombings

By October 1972, Hanoi had accepted Nixon’s peace proposals ensuring U.S. disengagement with honor and leaving South Vietnam intact; additionally, Linebacker I had eliminated the North’s ability to forcibly takeover South Vietnam (Clodfelter, 1995). South Vietnamese President Nguyen Van Thieu, however, had refused to endorse the

agreement, making additional demands that the North was unable to accept (Clodfelter, 1995). Nixon resorted to airpower once again in December, but with a slightly different aim. While Linebacker I had intended to destroy the North's war-making capacity (a resounding success), Linebacker II's objective was to eliminate the North's will to fight while reaffirming to Thieu that the U.S. was committed to the South's security (Clodfelter, 1995).

To break the will of the North to continue hostilities, Linebacker II directly targeted the population's will without targeting the population itself. Bombing missions began on 18 December, initially targeting the same infrastructure as during the earlier campaign. There was a renewed emphasis on not simply destroying the targets, but making the bombing highly visible to the population in order to dissuade them from continuing to support the war (Clodfelter, 1995). This shift in strategy is reminiscent of the early Douhet "punishment" strategies with one difference; the population was not to be targeted and killed per se, but to impose a hardship of round-the-clock violent disruption of their daily lives. While precision was desired to prevent unwarranted casualties, the main thrust was psychological. On the first night, 48 B-52 bombers struck railyards and airfields near Hanoi, followed at ten minute intervals by two additional flights (Clodfelter, 1995). Nixon kept up this pressure until the North began to entertain further negotiations; as they continued to hold out, Nixon intensified the bombing. On the 27th, 60 B-52's struck surrounding Hanoi targets, another 60 struck on the following two days; as the bombings continued, the levels of resistance encountered dwindled to eventually zero (Clodfelter, 1995). On 28 December, the North agreed to Nixon's proposals, and Nixon halted the bombing the next day.

Linebacker II differed considerably from Linebacker I, indicating the necessity of marrying the correct weapons capability to the correct strategy. During the first campaign, PGM's were critical to destroying the North's ability to wage war against the South. Pape (1996) describes this as a "denial strategy," where the attacker seeks to deny the adversary the means to achieve his political/military objectives. Linebacker I was tailored well to achieve this result, as precision weaponry could discreetly target the war-making capabilities that were fueling the conventional forces invading the South. Conversely, the goals of the December campaign were markedly different. The North's ability to fight in the South had been decimated, yet their will to resist persisted. This called for a different strategy not as reliant on precision capabilities. The goal was more psychological to reduce the North's will, not ability, to continue hostilities. PGM usage under these conditions would likely have been ineffective, since they are not designed to create the general disruption of the North Vietnamese population. What was called for in December was the catastrophic devastation and terror, not inflicted upon the civilians themselves, but on the surrounding countryside, creating an environment of constant explosions, noise, and fear.

4.8 Conclusion

Several themes that dominated the discussions during both air campaigns. First, collateral damage and civilian casualties were of more prevalent concern in the Johnson administration. The Rolling Thunder campaign was much longer (3 years) than the Linebacker campaign (6 months), therefore the mounting casualties became more salient

for Johnson. The advent of televised news coverage brought the reality of war home to the American people, and the tumultuous social times of the 1960's placed significant pressures on the administration to conclude the war. The strategy of gradual escalation sought to minimize the consequences of full-scale war and President Johnson consistently sought a middle-ground between those advisors who advocated unlimited air strikes and those that were more selective in attempts to bring the North Vietnamese to negotiations. Additionally, Johnson was constrained by the threat of involving the Chinese which threatened to widen the war, possibly into a confrontation with the Soviet Union as well. Domestic concerns appear to have driven the prolonged air campaign in the late 1960's, coupled with a faith that the escalation strategy would bring results while minimizing popular criticisms.

Nixon, by contrast, was elected in part to end the war and bring American forces home, however, he needed to do this in such a manner that the U.S. could "save face" and salvage its prestige. Nixon had at his disposal new weapons and capabilities that could minimize the negative impacts of collateral damage, and the population was perceived to be more accepting of enemy casualties in order to conclude the war quickly. Ground forces had been largely withdrawn by this time, and there was an "end in sight," and this consideration seems to have lessened the constraints on Nixon that Johnson had endured. Finally, the transition from a guerilla to a conventional war clarified the targets and increased the effectiveness of the air campaign, so Nixon could present to the American people positive results of success.

Secondly, the Joint Chiefs of Staff and the military leaders did not appear to alter their advocacy of what targets should be attacked to achieve the political and military

objectives. The military remained wedded to the idea that strategic bombing could win the war if the full potential was unleashed upon the North. This lesson was rooted in the experiences of World War II, and the military leaders felt constrained during the Rolling Thunder campaign as a result of both the gradual escalation policy and the political constraints of maintaining public support. The military also tried to prosecute a conventional war against a guerilla enemy. This affected target selection negatively in Rolling Thunder, but Linebacker (as the war shifted to conventional) seemed to validate their position all along. The introduction of better bombing technology and the increased vulnerability of North Vietnamese forces brought greater success, but the military misattributed this success to the lifting of constraints by the Nixon administration. It took years of reflection to realize the actual failures of the Rolling Thunder campaign, namely that the wrong kind of war was being fought and the limitations of the technology used to wage it. In summary, the military leaders remained wedded to the idea that attacking industrial and logistical targets could still be decisive in a guerilla war. The introduction of PGMs increased the air campaign's effectiveness, but the military drew the wrong conclusions when attempting to explain the failure of Rolling Thunder. They remained remarkably consistent with their strategy, and exhibited an inflexibility that military leaders still decry to this day.

Finally, public support of the war was initially strong in the Johnson administration, but it began to wane after the Tet Offensive in 1968. The North Vietnamese launched the Tet Offensive during a brokered cease-fire, catching the U.S. forces initially off guard. The U.S. quickly recovered and destroyed the insurgent uprising, but the narrative of the Johnson administration had centered on U.S. successes.

The public felt misled when the North was able to launch an offensive that they otherwise should not have been able to do. Walter Cronkite famously announced on national news that the “war was lost,” and public support began to plummet significantly. A theme emerged that President Johnson was much more susceptible to public opinion, as evident in the constant negotiating he had to conduct with the Congress to get support for the war. An influential group of senators sought to undermine U.S. policy, and this factor played largely on Johnson’s election campaign in 1964. By contrast, Nixon did not suffer the culpability of getting the U.S. involved in the war in the first place. He and his advisors seemed to think of themselves as the “fixers” who would get the U.S. out of the region (much akin to the Obama administration’s view on Iraq and Afghanistan). This gave the administration the impression that they were less constrained by public opinion than Johnson, and thus, could wage a more aggressive war.

A more detailed content analysis is required to discern the relative significance of each of these themes, but they all seemed to play a significant role in policy formulation. Central to these themes was the ability of the U.S. to conduct a successful war against communist expansion. Political leaders recognized that the war was limited, but the military leaders refused to acknowledge this aspect and insisted on waging a conventional war in the context of recent experiences in World War II. Both sides argued past one another as the means were sought that realize both the political and military objectives. While the shift in 1972 to a conventional war certainly facilitated success, the introduction of PGMs gave the national command players the capability to strike targets at the lowest cost and highest effectiveness. Had this capability been available during the late 1960’s, the military and political leaders may have been able to pursue gradual

escalation strategies without sacrificing military effectiveness or fueling popular disaffection with the war.

Chapter 5

Operation ALLIED FORCE: The Air Campaign over Kosovo

“After years of false promises by its most outspoken prophets, airpower has become an unprecedentedly capable instrument of force employment in joint warfare. Even in the best of circumstances, however, it can never be more effective than the strategy it is intended to support.”

--Benjamin Lambeth, 2001

5.1 Introduction

The purpose of this case study is to reveal the impact of PGMs on the Kosovo air campaign's outcome and duration, highlighting the successes of advanced technology while balancing its limitations in the context of political considerations and restrictive rules of engagement. The empirical findings of this study thus far indicate that higher levels of precision in any given air campaign increases the likelihood of that air campaign terminating sooner. The air war over Kosovo, however, provides an example of a campaign with the highest levels of precision lasting longer than previous campaigns since the end of World War II. The purpose of this case study is to explore why this apparent anomaly occurred. This analysis concludes that the mere presence of precision alone is not enough to explain the termination of a campaign; the strategy employed and the political considerations of the engaged states shape the combat environment and can either foster or hinder the effectiveness of advanced technology in warfighting. Specifically, the Kosovo air campaign provides an example of such considerations as the states allied against Serbia faced limitations in the prohibition of ground forces, the political tensions of alliance cohesion, and the resulting gradually escalating nature of the campaign. All these factors contributed to the campaign duration, and it is plausible to

conclude that the campaign may have ended earlier than it did had these factors been addressed differently.

NATO conducted this air campaign against a nationalist leader who had made his political success based on the idea of Serbian unity (Milosevic, 1989). The province of Kosovo plays a significant historical role in the psyche of the Serbian people. Milosevic capitalized on this sentiment to address a threatening demographic shift in the province by ethnically cleansing the region of non-Serb populations. A humanitarian crisis emerged propelling NATO into the greatest test of its existence. To remain relevant, and to maintain stability in southeastern Europe, NATO waged an air war with the objective of ending the ethnic violence and alleviating the refugee crisis. Popular sentiment amongst the allies prohibited the introduction of ground forces, and NATO thus adopted a phased gradually escalating air campaign to force Milosevic to change behavior. The phased approach initially failed, due to the improper identification of Milosevic's centers of power. Despite the technology of PGM's, the strategy hampered their effectiveness. Once NATO shifted to appropriate targeting strategies, the advantages of PGM's were realized.

From 24 March to 9 June 1999, NATO air forces conducted a 78-day air campaign (Operation ALLIED FORCE) to halt an ethnic cleansing program against Kosovar Albanians in the former Yugoslavia. Airpower supporters have often hailed this campaign as proof that airpower alone can win wars; after all, Serbian President Slobodan Milosevic conceded to NATO and United Nations demands without the use of allied ground troops. At first glance these claims appear to be validated; however, the exact reasons why Milosevic capitulated have sparked much debate. PGM's provided the

capability to strike any target under virtually any conditions, yet the strategy under which these munitions are employed can either foster or hinder their effectiveness in bringing about a swift termination of the conflict. Operation ALLIED FORCE represented military technology at its zenith operating under significant political limitations, highlighting the importance of the proper military strategy to maximize military capabilities. It is premature to claim that airpower alone can win wars without considering the political limitations often imposed on military engagement. It is not clear that Milosevic capitulated solely due to the bombing campaign. Some have argued that it was the loss of both international support, pressure from his domestic winning coalition, and the implied threat of an eventual NATO ground invasion (Hosmer, 2001). There are three main characteristics of this air campaign that require a closer scrutiny of the effectiveness of precision airpower. These aspects will be outlined below with particular attention to their impact on the effectiveness of PGMs.

Several aspects of this campaign can help explain the impact of PGMs on its duration and eventual successful outcome. First, from the beginning, stated NATO policy prohibited use of any combat ground troops, placing the burden of success on the exclusive use of airpower. For the first time in its history, NATO forces attempted to coerce an adversary who understood at the outset that it would not be subjected to a foreign invasion or occupation. Additionally, the prohibition on ground forces was announced publicly prior to the initiation of hostilities, thus communicating to Serbian leadership the limitations NATO was imposing upon itself. Secondly, the campaign was conducted multilaterally within the NATO alliance, where strategic and operational decisions relied on consensus of the 19 member states. This arrangement placed high

premiums on maintaining alliance cohesiveness, avoiding collateral damage, and minimizing friendly forces losses (Lambeth, 2001). The final characteristic was a result of the first two as the air plan adopted required the gradual escalation of air attacks intended to coerce Milosevic into accepting NATO demands via the threat of future air attacks. These constraints acted to limit the aggressiveness of the initial bombing and to curtail the implementation of escalation if Milosevic did not comply with NATO demands. The escalation strategy had the effect of dragging out the air campaign. The gradual nature of the bombing led Milosevic to question the resolve of the NATO allies, encourage international sympathy to force NATO to halt the bombing, and allowed him to maintain his political support at home. Before these characteristics are explored, it is necessary to understand the historical and strategic context of the Kosovo conflict, and how PGM's had come to play a more prominent role in air campaigns since the 1970's.

5.2 Kosovo PGM Usage in Context

PGM usage had more than quadrupled since the Gulf War (1991) alone, and the technological capabilities had enabled these weapons to act virtually autonomously of human intervention. Despite this technological advancement, Operation ALLIED FORCE lasted much longer than previous campaigns. PGM usage during the Vietnam War occurred late in the conflict (1972), and they were used predominantly during the brief Linebacker campaign (see previous case study for more details on the Vietnam conflict). These new weapons accounted for less than 1% of all munitions dropped during the Vietnam War (Lambeth, 2001). During the first Gulf War (1991), the percentage of PGMs increased to 8% (Lambeth, 2001) of all munitions employed, but the technology

had not advanced significantly since Vietnam. Air forces still relied on laser targeting, third-party designators, and were subjected to the limitations of weather. During the Kosovo campaign, PGM usage increased to 35% of all munitions employed, incorporating more advanced technology in the form of GPS guided bombs that did not rely on third-party designators and could be autonomously targeted against geographic coordinates (Lambeth, 2001). Additionally, during the Gulf War (1991), only 10% of coalition aircraft were equipped to drop these new weapons (Congressional Report, 2000). During the Kosovo air campaign, modifications to aircraft systems increased this to 90%, allowing a broader array of aircraft platforms that could utilize the increased precision (Congressional Report, 2000).

Despite the increase in PGM technological capabilities and the greater employment of such weapons, there is an interesting observation that appears to contradict the results of this research. The air wars in these more salient campaigns actually lasted longer as advances progressed in the employment of PGMs. The Vietnam Linebacker campaign in 1972 lasted initially for five and a half months (Linebacker I) and witnessed the first employment of significant numbers of PGMs, and is generally considered a success in bringing the North Vietnamese to the negotiating table. Talks, however, floundered and the U.S. initiated Linebacker II. The second campaign was more decisive, only lasted 7 days, and succeeded in restarting negotiations to set the stage for eventual U.S. withdrawal. The Gulf War (1991) air campaign saw an increase in PGM usage and lasted only 37 days (followed by 4 days of ground combat), resulting in an overwhelming victory for the coalition forces against Iraq (Lambeth, 2000). By Kosovo, PGM usage increased to 35% of all munitions dropped, but the air campaign was the

longest of all three (excluding Linebacker I), lasting 78 days before Milosevic capitulated (Lambeth, 2000). One would expect from the statistical results of this research that the Kosovo air campaign should have ended much sooner (indeed, NATO and U.S. leadership believed just that); however, several strategic and political factors intervened that essentially hampered the effectiveness of the overall campaign regardless of the technology used by military forces. These factors are discussed below to provide a nuanced approach to evaluating the effectiveness of PGM technology on Operation ALLIED FORCE, but they are applicable to any air campaign as military and political leaders seek the best coercive strategies to advance national interests.

5.3 Milosevic, History and Holding onto Power

Prelude to Conflict

Serbian President, Slobodan Milosevic came to power in 1989 amidst an increasing rise in ethnic tensions in the autonomous province of Kosovo. Milosevic eventually became the target of the coercive air campaign in Kosovo, but in order to evaluate the effectiveness of the air campaign (and hence its success) one must understand the stakes and costs to Milosevic's decision making in acceding to NATO's demands. His ultimate capitulation was sudden and took the allies by surprise, in fact, much has been written about 'why' he surrendered when he did. To fully understand the effectiveness of air power upon the Milosevic regime, an understanding of its interests is required.

As a province within the Serbian republic, Kosovo underwent a demographic shift over the past 38 years. The conflict over the province's autonomy was rooted in the

emergence of a large Albanian demographic in the heart of Serbian history. On 28 June, 1389, the Battle of Kosovo was fought against the Ottoman Turks. The Serbs lost this battle, and subsequently endured over five hundred years of Ottoman rule. In the latter half of the 20th century, a fateful demographic shift occurred that put the province on a collision course with its parent-state, Serbia. In 1961, the Albanian population of Kosovo was 67% Albanian Muslim and 24% Orthodox Serb (Huntington, 1996). A higher birthrate amongst the Albanians glutted the labor force with young Muslims, driving many of the Serbs out of Kosovo in search of work (Huntington, 1996). “As a result, by 1991, Kosovo was 90% Muslim and 10% Serb” (Huntington, p. 260, 1996). This demographic imbalance sparked a series of conflicts between the Albanian Muslims and the Orthodox Serbs, and from the 1970’s to the late 1980’s, the province was subjected to violent protests, political intimidation of the Serbs, and widespread discontent across the Serbian populations of the former Yugoslavia (Huntington, 1996). Kosovo then sought to politically elevate itself to the status of a Serbian republic, thus sparking the rise of a Serbian nationalist named Slobodan Milosevic.

In order to fully understand Milosevic’s motivations and national interests, one must look no further than his speech on 28 June, 1989 to commemorate St. Vitus Day, the historic battle of Kosovo some six centuries before. His audience was the Serbian population dealing with the social and political conflict of the emerging Albanian Muslims. He advocated unity and dignity of a great and proud Serbian nation, “...it remains certain that the people regarded disunity as its greatest disaster” (Milosevic, 1989). He fully recognized throughout the address that the greatest plague to Serbian prosperity has been its ethnic strife in a highly multicultural society, and his objective

was to unify the Serbian people in order to prosper in the European and global international system:

“I am convinced that this awareness of harmony and unity will make it possible for Serbia not only to function as a state but to function as a successful state. Therefore I think it makes sense to say this here in Kosovo, where that disunity once upon a time tragically pushed back Serbia for centuries and endangered it, and where renewed unity may advance it and may return dignity to it” (Milosevic, 1989).

This appeal to Serbian nationalism helped elect Milosevic to power, and it would remain the populist position throughout his ethnic cleansing campaign and the subsequent NATO air attacks. In any evaluation of the effectiveness of the bombing and Milosevic’s resistance, one must consider the Serbian popular resolve to hold out until the NATO forces grew weary and sought a settlement. The gradual escalation of the air war will be examined shortly, but the political considerations of the Milosevic regime threatened to undermine such a strategy from the outset.

In addition to the popular support Milosevic required to maintain power, he also needed the support of party and manufacturing leaders and otherwise influential persons that benefitted from a strong economy. As the bombing proceeded, I will examine later how the strategy affected these elements of his power, and how the gradual escalation campaign, as well as the strategic objectives initially laid out by NATO, were doomed from the start.

The ethnic conflict in the Former Republic of Yugoslavia (FRY) began to intensify throughout the early 1990’s in Bosnia Herzegovina and Croatia, where the U.N. sanctioned a limited air campaign that ended the indiscriminate shelling of Bosnian villages, but otherwise these campaigns were short lived and did not fundamentally solve the ethnic problems in the region. In Kosovo, the establishment of the Kosovo Liberation

Army (KLA: a partisan military organization composed of Albanian Muslims using force to achieve independence) led to an increase in violence with Serbian forces. The west had largely relied on the diplomatic track, using the U.N. to pass resolutions condemning the violence and embedding Organization for Security and Cooperation in Europe (OSCE) units in affected areas to monitor compliance; however, these efforts proved ineffectual as OSCE observers stood by powerless while Serbian forces continued to kill Kosovar Albanians (Lambeth, 2001).

The final act that triggered the aggressive response of NATO was the massacre at Racak on January 15, 1999, where Serb forces entered the village in pursuit of the KLA and proceeded to slaughter 45 Albanian civilians (Lambeth, 2001). As a result, on 30 January the North American Council (NAC: the political arm of NATO) authorized air attacks if Serb leaders continued to refuse negotiations with the Kosovars (Lambeth, 2001). This set the stage for the Rambouillet talks which sought to define the terms of a cease fire, an interim peace settlement, a system of self-government for Kosovo, and the deployment of international troops to enforce the terms (Hosmer, 2001). By 23 February, Milosevic had refused to sign and began plans to step up the ethnic cleansing by launching Operation Horseshoe, where 40,000 Serbian paramilitary troops began burning and pillaging villages in the Drenica region (Lambeth, 2001). The U.N. High Commissioner of Refugees reported that, as a result of the latest campaign, 240,000 persons were internally displaced and 60,000 rendered homeless (Lambeth, 2001).

The humanitarian crisis was now receiving significant international attention, and the Clinton administration dispatched Ambassador Richard Holbrooke, on 22 March, in a last effort to persuade Milosevic to halt the violence. Holbrooke threatened Milosevic

that if he did not cease the ethnic violence, NATO would begin bombing targets in Kosovo as well as Serbia proper (Lambeth, 2001).

5.4 The Air Campaign: Operation Allied Force

The Air Campaign Plan

The objectives of the campaign followed the requirements laid out in the Rambouillet accords, requiring Milosevic to halt the ethnic violence, withdraw Serbian para-military forces, recognize the autonomy of the Kosovo province, and allow the peaceful return of all refugees (S.C.R. 1244, 1999). The strategy followed, and the disagreements that ensued, reflected a competing theoretical framework on the effectiveness of air strikes. One side desired to inflict overwhelming damage on the regime, while the other advocated a gradually escalating campaign to coerce Milosevic over time. One plan called for a gradual escalation of air attacks to coerce Milosevic to concede to NATO demands. This approach was not new, as Schelling (1966) had advocated via the “threat of damage, or of more damage to come that can make someone yield or comply” (p. 3). In other words, the amount of damage inflicted must gradually increase, threatening more severe attacks in the future, without inflicting such destruction as to back the target state into a corner leaving him no options but to fight. Pape (1996, 1990) found that these escalation strategies tend to fail while the adversary still has the means to conduct his military strategy. Brief acquiescence of the target state is often used to buy time, rearm, regroup, and re-attack (Leonard, 1994). The goal of the attacker thus becomes to deny the target the ability to prevail in the conflict, to diminish his ability to counter-escalate against the coercing state (Byman, Waxman, and Larsen, 1999).

The scope of the airstrikes had broadened from a mere 48-hour bombing campaign, followed by a halt to allow Milosevic to respond, to an extensive campaign where infrastructure targets were included along with the actual Serbian forces engaged in the atrocities (Lambeth, 2001). At the outset of the planning, there was a difference of approaches taken by both the U.S. and the NATO leadership. The U.S. military wanted an overwhelming and intense air campaign from the start, striking a wide range of targets on both the Serbian military and the infrastructure (Lambeth, 2001). This approach was influenced by the success of the Gulf War (1991) and the air power theory advocated by Warden (1989). NATO, however, opted for a gradual escalation approach (Schelling, 1966) to give Milosevic time to reconsider his obstinacy and begin implementation of the Rambouillet requirements (Lambeth, 2001). From a strategic perspective, these two plans differ considerably in the manner in which they are executed, and the disagreements amongst the U.S. and its allies would have lasting consequences in the attempt to maintain allied cohesion. These challenges will be detailed in the lessons-learned section below, but for the purpose of evaluating PGM's, it is important to note that strategy drives the effectiveness of any technology. The weapons are capable of destroying any target, but the political and military objectives may not be realized simply by blowing something up. The focus of modern airpower strategists is on the ability to achieve a desired "effect" (Meilinger, 2007) against the adversary that degrades his ability to resist. The proper intensity of the air campaign was a contentious issue amongst the allies and the result of differing theoretical frameworks within which the air war was expected to be effective.

The campaign's final plan called for three phases: first, planners targeted the integrated air defense system (IADS) and fixed army installations, with the goals being to soften up Milosevic's defenses and to demonstrate precise air attacks with minimal collateral damage (Lambeth, 2001). NATO's objective was to inflict just enough pain on Milosevic to encourage him to halt the violence and return to serious negotiations. The second phase included attacks against military targets below the 44th parallel that bisected Yugoslavia south of Belgrade; the final phase included the bombing of military facilities north of the 44th parallel and against industrial and infrastructure targets in Belgrade itself (Lambeth, 2001).

The First Phase and Results

Combat operations commenced on the night of 24 March, and the primary objective of NATO forces was to secure control of the airspace over Serbia and Kosovo. This entailed destroying the IADS sites as well as any Serbian fighter aircraft that may rise to challenge the attacking aircraft. The first shots fired, however, came from strategic bombers and naval ships operating outside of the FRY airspace. Surface ships, submarines and B-52 bombers launched a total of 55 cruise missiles against hardened targets, including the electrical power grid in the Kosovo capital of Pristina; this cut off all electricity to Pristina and blacked out the entire city (Lambert, 2001). Conventional Air Launched Cruise Missiles (CALCMs) and Tomahawk Land Attack Missiles (TLAMs) were ideal for the first wave attacks. These cruise missiles are highly precise and are guided by GPS and Inertial Navigation Systems (INS) to precisely guide the warhead to its final target. Additionally, they are unmanned missiles, can be launched

hundreds of miles away from hostile forces, and therefore possess zero probability of losing a pilot to enemy defenses. While a significant portion of these targets were successfully destroyed, the CALCMs suffered a severe failure rate; no single bomber used to launch these weapons ever successfully fired all eight of its missiles (Lambeth, 2001). Technical difficulties prevented the full effectiveness of this weapon.

The bulk of the first targets struck consisted mainly of military targets, what Robert Pape (1996) called “denial” targets (radar sites, airfields, electrical power, military barracks, weapons factories, and command and control nodes) (Lambeth, 2001). These were targets that eliminated the Serbian forces’ ability to wage a military campaign against the NATO allies. Pape concluded that ‘denial strategies’ were more likely to bring about an end to an air campaign, but ALLIED FORCE was not fought against conventional military forces using conventional military tactics. Serbian forces, not facing a ground threat, were able to disperse and deploy their troops, tanks, and artillery throughout the mountainous and inaccessible terrain. When Milosevic stepped up the ethnic cleansing program in Operation Horseshoe, he did so with small bands of paramilitary squads free to move undetected into and out of Kosovar villages. Despite the precise nature of the weapons employed, if the key to halting the ethnic cleansing program was to destroy those forces conducting such atrocities, those targets could not be located in time to plan and execute a bombing mission against them.

The expectation at the outset of air operations was that the campaign would short, decisive and effective at bringing Milosevic back to the negotiating table. Secretary of State Madeline Albright declared on the first night of attacks that she did not believe the war would be a “long term operation” (Correll, 1999). The 3-phase air campaign was

planned and presented to NATO months prior to the bombings, but by 30 January only the first phase had been approved; the assumption was that the follow up phases were not going to be necessary, as Milosevic would certainly capitulate before they were needed (Lambeth, 2001). The reality on the ground dictated otherwise, in that Milosevic was able to weather any bombing as long as his political and popular support remained strong. This would change, but not until a shift in strategy occurred.

The first phase of the air campaign impressively showcased the strike capabilities of PGM's, but the strategy it was wedded to doomed such capability to fostering a quick outcome. NATO air forces were adept at destroying supply dumps, airfields, barracks and radar sites, but these were fixed targets impossible to quickly remove and not essential for the detached and autonomous operations used to increase the terror operations on hapless Albanian civilians. After four days of bombing, NATO leaders recognized that the sought effects were not being realized and therefore had to initiate a second phase to raise the stakes against Milosevic. After a week of airstrikes, the Clinton administration had to admit that the goals of the strikes were not being met; additionally, the Pentagon declared that even though the bombing has "...wreaked significant damage on the Yugoslav military and its equipment,...it has proved unable to block a brutal campaign by the Yugoslav army and police of executions and forced exile of ethnic Albanians" (Graham and Drozdiak, 1999). The main targeting shifted to the fielded Serbian forces conducting the atrocities, but locating them proved difficult, and when they were found and destroyed Milosevic was able to weather the losses.

The Second Phase and Results

According to the After Action Report to Congress, “Phase 2 would attack military targets in Kosovo and those Yugoslav forces south of 44 degrees north latitude, which were providing reinforcement to Serbian forces in Kosovo” (Congressional Report, 2000). After bogging down in a fruitless attempt to halt the ethnic violence, NATO shifted to concentrate on the actual Serbian forces themselves responsible for carrying out the atrocities. Differentiating between Phases 1 and 2 is difficult, and some have likened it not so much as a shift but as an evolution of strategy (Lambeth, 2001). The realization had set in that the campaign was not going to be short and decisive. The political pressure for NATO to do something else likely came from the fact that despite the first four days of successfully destroying military infrastructure, Milosevic was able to accelerate his terror operations on the Albanians. The dispersal tactics of the Serbian ground forces and bad weather complicated the task of finding, let alone engaging, hostile forces. PGM’s were unable to affect the outcome of a strategy they were not designed to follow.

PGM’s are capable of attacking fixed targets, day or night, and in any weather. The key term is “fixed,” in that these weapons rely on guidance systems that “know” where the target is. For example, a military base is stationary, and targeting personnel can “fix” the geographic coordinates of the structure, program it into a bomb, and the bomb can use GPS signals to guide itself to the target. This technology is rendered inoperative when the target is a vehicle carrying Serb troops, mobile artillery or small units of Serb troops marching into a village. Even when bomber aircraft can get lucky enough to spot these mobile targets, the close quarters with which enemy troops are in with innocent civilians makes collateral damage that much more likely. Crews unable to identify their targets via weather or via close proximity to civilians and civilian structures were unable

to engage. More than half of the strike sorties on night missions returned to base without dropping their weapons due to weather or inability to identify targets that could be safely engaged (Lambeth, 2001). Additionally, not all PGM's employed were GPS guided. Laser Guided Bombs (LGB's) require a laser to illuminate the target; the bomb then follows the laser to the target guaranteeing pinpoint accuracy (as long as the laser beam remains on the target). Cloudy conditions prevent these lasers from being used, as the water particles in the clouds deflects the light and renders aiming impossible.

Finally, complicating the task of engaging highly mobile and concealed ground forces, pilots often needed to make visual identification of the targets in order to judge the danger to civilians and thus preclude politically-unfriendly collateral damages. To do so required pilots to descend to lower altitudes in order to "see" the targets. This placed aircrews at increased risk of Serbian air defenses; losses of NATO aircrews were too high of a risk in a fragile coalition of NATO states, thus further preventing the destruction of Serbian death-squads. From the outset of the operation, NATO pilots were prohibited from flying below 15,000 feet in order to prevent aircraft and crew losses (Lambeth, 2001). These restrictive rules of engagement (though well meaning) mitigated or eliminated any advantage that PGM technology brought to the air campaign. Eventually, these limitations were addressed in the final phases of the war, where it became more effective to target the Milosevic regime and his supporters to force a change of Yugoslav policy.

The Third Phase and Results

Phase 3 greatly expanded the target list to a wide array of military and infrastructure targets, to include those in the vicinity of Belgrade (Congress Report, 2000). Attacks were now conducted on the nerve centers of the regime, and represented a turning point in the war that culminated in Milosevic's capitulation. NATO struck military leadership, command centers, bridges, weapons depots, fuel supplies, railways, and the water supply (Lambeth, 2001). These types of targets are well-suited to PGM capabilities. The targets are "fixed," so the coordinates are easy to program into the weapons; the civilian population concentrations are relatively known and static, thus allowing tailored targeting by adjusting impact points and explosive yield to minimize casualties; and finally, the weather is less of a factor, as the weapons required can be launched from high altitude or at greater standoff distances, thus minimizing threats to the aircrews. The most important result of this shift in strategy, however, is the impact it will have on the Milosevic regime. Belgrade, though initially off limits, represents the power center of the regime. The Belgrade population (and those of other cities) was now directly impacted by the loss of water, transportation and electrical power. Additionally, Milosevic's cronies began to feel the deprivation of having their factories bombed and their economic interests threatened. The regime was highly supported by the powerful elite that profited from the economy and pulled the levers of political power. To lose the support of these key figures would exert the greatest pressure on Milosevic to concede to NATO demands. These aspects will be addressed below in explaining why the regime capitulated, but the point is important here because these targets, guided by the Phase 3 strategy, allow the maximization of PGM capabilities. Wedded to the proper strategy, the technology can be decisive. It is my conclusion that the relatively lengthy air campaign

over Kosovo mostly resulted from a misidentification of the Yugoslavian center-of-gravity that dictated the power interests of Milosevic.

However intelligent the logic for shifting targeting focus, the campaign remained stalled as the NATO allies found it more difficult to agree on which targets could be struck. Targeting became especially sensitive as the air forces began striking industrial infrastructure. NATO representatives began vetoing target selections based on the political implications of collateral damage. For example, some Serbian barracks were disallowed from attack out of concern that too many helpless conscripts might be killed (Lambeth, 2001). The Dutch even vetoed the attack on Milosevic's presidential palace because it was known that there was Rembrandt painting located there (Lambeth, 2001). While Phase 3 had opened the door to increased targeting of the main power structure of the regime, it was still stalled out due to bombing limitations. After five weeks of bombing, it did not seem that Milosevic was ready to capitulate. One last escalation, decided on the 50th Anniversary of NATO, would set in motion Milosevic's eventual capitulation.

Final Escalation

The escalation occurred in the latter weeks of April as NATO recognized the risk of losing credibility from a stalled out bombing campaign. Milosevic remained in power, was showing no signs of capitulating, and the refugee crisis was worsening. NATO leaders now decided to escalate the campaign and strike the "four pillars of Milosevic's power," namely the political machine, the media, the security forces and the economic system (Lambeth, 2001). Beginning on 21 April, three cruise missiles destroyed the radio

and television stations run by Milosevic's wife, the last bridge over the Danube in Novi Sad was destroyed, and the offices of Milosevic's political party supporters were attacked (Lambeth, 2001). The electrical grid in Belgrade was attacked by May 3rd, shutting off power to 70% of the country (Lambeth, 2001). The hardships of the war were now being felt by the Serbian people themselves, and the pressure began mounting on Milosevic as his political supporters saw their factories and businesses destroyed, taking with it the economic prosperity they previously enjoyed. The popular demonstrations in support of the regime were becoming less frequent as Milosevic began losing support of his citizens as the impact of the bombing put 100,000 civilians out of work (Lambeth, 2001). As the last weeks of the air war approached, these attacks on the political and economic infrastructure only intensified; Yugoslavia's civilian telephone and computer networks were attacked to cut off all communication with the Kosovo province (Lambeth, 2001).

NATO's shift in strategy in the latter half of the air war to targeting infrastructure and the bases of Milosevic's power seemed to be paying off. The civilian population actually responded negatively to the regime as a result. This aspect seems to contradict the prevailing theories on airpower, and a brief word on this anomaly is needed to understand the changing nature of precise air campaigns.

One of the earliest airpower theorists, Italian Air Marshall Giulio Douhet, advocated that the strategic bombing of wholesale civilian populations would place enough political pressure on the enemy regime that the leaders would capitulate before any troops were needed to occupy the country (1921). This theory was tested during World War II as the mass fire bombings of German and Japanese cities attempted to erode the morale of the populations to the point that their leaders would surrender rather

than endure the wrath of their constituencies. The Germans also attempted this strategy by bombing the British populations indiscriminately during the 'Blitz.' The lesson that emerged from that war was that this strategy does not work. The U.S. Strategic Bombing Survey (1946), conducted by physical assessment of damage and through interviews with the defeated citizens, concluded that the continual bombing of population centers only acted to strengthen the resolve of the people. Robert Pape characterized this method of attack as "punishment strategies," where an attacker attempts to punish the population into submission and overthrowing their present regime (1996). Pape concluded as well in his empirical findings that such strategies do not achieve the desired outcome, but something different was happening in Belgrade during this air campaign.

The Serbian population was not being bombed indiscriminately; conversely, they were being bombed precisely. Collateral damage was miniscule compared to the millions that were killed during World War II. General Wesley Clark remarked that ALLIED FORCE was "the only air campaign in history in which lovers strolled down riverbanks in the gathering twilight and ate at outdoor cafes and watched the fireworks" (Clark in Lambeth, 2001). The Serbian people's experience was much different than that of World War II Europe, in that they had reasonably high expectations that they would survive the NATO bombing of their electrical power, television, factories, and transportation systems. Once the war was over, they could be fairly confident that they would be suffering deprivation, loss of income, and food and electricity shortages. The precise nature of PGM's did not require that the populations themselves be attacked to encourage popular resistance to the Milosevic regime; however, the people's very way of life was being systematically destroyed as they sat helpless with the near certain belief that they

would survive and have to rebuild it all. While this ‘psychological’ argument is not conclusive, it is indicative that something may have changed in regards to the effects of strategic bombing that targets civilian populations indirectly. After all, many credit this loss of popular support for the regime as one of the main causes of success. Why exactly Milosevic surrendered when he did is evaluated next, but in the context of the effects of PGM’s on the air campaign and how the bombing turned his political support against him.

5.5 Milosevic Capitulates

On June 3rd, Milosevic accepted NATO’s terms and began the process of bringing the conflict to a close. The questions arise as to why Milosevic surrendered when he and not earlier. Conversely, why did Milosevic not hold out longer for more favorable terms? These questions will be examined in the context of the effectiveness of the air campaign to lead Milosevic to the conclusion that continued resistance was futile. Specifically, what role did PGM’s play in each of the explanations for his surrender. I argue that PGM’s only had a positive impact when their usage was wedded to the correct air strategy. Particularly, PGM’s were critical when employed to attack his base of political and popular support. They provided the military capability to destroy the means of survival of his elite support without decimating the country and killing thousands of innocent civilians. Conversely, the early phases of the war saw a less influential role for PGM’s, as the campaign struck only the dispersed military targets conducting the ethnic violence. Milosevic was capable of waiting out such a campaign, and he demonstrated the ability to continue production of replacement arms as well as sending in

reinforcements to compensate for troop losses. The means of production were still intact, and as long as NATO focused on military targets, Milosevic reasonably believed NATO's resolve would weaken first. While PGM's were capable of destroying these military targets, their use did not contribute to the overall success of the NATO strategy.

5.6 Limited Bombing Protects Milosevic

As demonstrated above, the initial campaign employed a strategy of gradual escalation. NATO planners believed that Milosevic would accept their demands after a brief 48-hour period of bombing. Milosevic assumed that any air campaign would be of limited duration and severity (Hosmer, 2001). Additionally, he believed that the increase in ethnic cleansing after the bombing had begun would discredit NATO, as the international community would view the bombing as exacerbating the refugee crisis instead of solving it (Hosmer, 2001). The initial phases of the campaign seemed to bear these assumptions out; indeed Operation Horseshoe did step up the violence on the Albanians and create a refugee crisis that placed a lot of pressure on NATO. In response, the air strategy in Phases I and II was largely aimed at preventing Serb para-military forces from inflicting violence within Kosovo, but these attacks proved ineffectual in stemming the capabilities of Serb forces. The lack of a ground threat (which Milosevic understood) allowed Serb forces to disperse and conceal themselves to avoid detection and wholesale destruction when they were found. The precision of NATO weaponry was well known to Milosevic and Serb commanders, and the lack of a ground invasion threat played into Serbian hands. They simply denied NATO targets to attack, and they never presented a massed concentration of troops that PGM's could engage. Serb forces

operated in small groups, ransacking and pillaging villages at will under the cover of weather and difficult terrain. Concerned with the political implications of collateral damage, NATO leaders required allied pilots to return home with their weapons if they could not positively identify targets.

Additionally, NATO and the international community's resolve proved to be stronger than Milosevic anticipated. Instead of the refugee crisis forcing NATO to cease bombing, the international outrage only intensified. NATO, NGO's and humanitarian agencies began to airlift supplies and food rations to mitigate the hardships of the refugees (Hosmer, 2001), thus giving a glimpse to the outside world the atrocities Milosevic was inflicting upon the Albanians. In fact, it was the international pressure over the refugee crisis that justified the increase in intensity and the shift to infrastructure targets of the air campaign. As a result, NATO escalated to the point that Milosevic could no longer rely on a limited campaign against him, and thus threatening his regime's survival. Milosevic's assumptions at the beginning of the campaign turned against him, as he escalated ethnic violence hoping for the collapse of NATO resolve, NATO in turn escalated as a result of the humanitarian crisis and strengthened its resolve. The shift in air strategy was necessitated by Milosevic's actions, and thus was able to maximize the true power of PGM technology on the battlefield.

5.7 Widened Bombing Threatens Milosevic

After a month of bombing, the Serbian public's attitudes began to change as they began to suffer the consequences and deprivations of the attacks (Hosmer, 2001). The population still expressed defiance towards NATO, but they were becoming war-weary

as their hospitals, bridges and power stations were destroyed (Erlanger, 1999). Once the air strategy shifted to infrastructure targets, PGM's became crucial. Not only were such targets fixed and difficult to conceal, but they were often nestled within the tight confines of urban environments. The ability to destroy a factory with minimal collateral damage would not exist without the technology PGM's brought to the fight. Often such targets were attacked at night when there would be minimal workers present or bustling crowds outside the facility (suddenly, being a Serbian night janitor became one of the most hazardous occupations in Yugoslavia). PGM's allowed these attacks to be conducted at night or in bad weather, each weapon could be specifically targeted to only strike a portion of the building, and could minimize damage to surrounding structures by detonating at a predetermined impact angle.

Five weeks into the campaign, Serbs were reporting suffering hardship as a result of the bombing, in fact, a public opinion poll in May revealed that 71% of Serb citizens reported suffering some form of privation resulting from shortages of goods (Hosmer, 2001). Additionally, 42% of adults reported having to move from their homes to find safer locations (Hosmer, 2001). The hardships of the citizens were beginning to turn against the regime, as one Serb was quoted, that people were dying "...for the reputations of politicians on both sides" (Erlanger, p. A-1, 1999). Finally, concerns about casualties started to prompt anti-war protests from Serbian citizens (Hosmer, 2001). Since Milosevic's escalation into Kosovo, many Serbian men had been conscripted and reservists had been called up for service in Kosovo; there was widespread fear and uncertainty regarding future casualties in the region (Hosmer, 2001).

From an airpower theorist's perspective, it appears from the Serbian public reaction that air campaigns against population centers may prove effective at increasing discontent towards the ruling elite. At first glance, this may overturn empirical evidence to the contrary, namely that "punishment" campaigns are ineffective at terminating an air war. This conclusion is premature, however, in light of the contributions of PGM technology. Previous air campaigns targeting population centers were typically indiscriminate and waged with the sole intention of terrorizing citizens. The PGM attacks were anything but indiscriminate, and the population had reason to believe that they were likely to survive only to suffer another day. PGM's minimized collateral damage to such an extent that comparing this punishment strategy with those of the past may be inappropriate. A psychological study would be required to verify this premise, but it is logically sound to assume the intentions behind violent action would mitigate the responses of the victims of air war.

In addition to Milosevic's increasing loss of support from the public, the political and economic elite began to suffer the losses of their livelihoods. Initially, members of the opposition parties rallied around the flag to support Milosevic's bid to hold onto the historical significance Kosovo province (Hosmer, 2001), but as the war progressed and popular dissent increased, this support waned. On April 25th, Deputy Prime Minister Draskovic publicly urged a compromise with NATO allowing an armed U.N. force, and some NATO troops, to police a peace settlement (Hosmer, 2001). Even though Milosevic fired Draskovic, the sentiment spread to city mayorships and leaders of opposition parties; calls for a settlement ensuring international monitoring and continued Serb control over Kosovo grew stronger (Hosmer, 2001).

The economic elite also began to pressure Milosevic to attain a settlement. An antiwar faction emerged in Milosevic's inner circle, supposedly including even his wife, Mira (Hosmer, 2001). The cause of this pressure appears to have stemmed from the aerial bombing of six types of infrastructure targets: 1) command, control and communication; 2) electrical power production; 3) industrial plants and manufacturing; 4) leadership; 5) Lines-of-communication; and 6) Petroleum, oil and lubricants production (Hosmer, 2001). These targets represented about 55% of the 420 targets attacked during the course of the air campaign, with the expected result of bringing popular pressure on the regime to concede (Hosmer, 2001). By June 2nd, NATO bombing had destroyed 50 highway and railroad bridges, 2 oil refineries and a substantial portion of petroleum reserves, 14 industrial facilities, and 9 electric power generating facilities (Hosmer, 2001). According to some estimates, it would take 15 years and require tens of billions of dollars to repair the damage in a country that began the war in financial distress (Hosmer, 2001). The government could no longer pay its troops and pensions, the agricultural harvest was endangered, and unemployment skyrocketed as the bombing had cost some 600,000 Serbians their jobs (Hosmer, 2001).

The air attacks successfully weakened the Milosevic's mechanisms of control over the country, and especially impacted the economic elite he relied upon for political support. Coupled with the popular discontent that was emerging late in the war, it was evident that Milosevic had to find a face-saving compromise with NATO. This situation is unlikely to have occurred had it not been for the escalation of the conflict to include those targets that directly impacted Milosevic's ability to maintain power. Once the strategy shifted away from attacking the fielded Serbian military forces, PGM technology

realized its full potential. Not only were infrastructure targets easier to identify, “fix,” and destroy, but NATO’s ability to assess the damage improved over the experiences in attacking highly mobile and dispersed military units. It is much easier to determine if a bridge or power grid is damaged than small military squads and vehicles. Furthermore, the destruction of a munitions factory virtually cuts off the supply to the troops needed to wage ethnic violence.

5.8 Conclusion

This indirect approach to degrading the enemy’s ability to wage war is often called “interdiction” in military parlance, and the concept has been around since World War II. Air planners during that war advocated the theory of the “Industrial Web,” thus driving targeting against ball-bearing and manufacturing plants in Germany. If the key ingredients needed to wage war are denied the enemy, then one does not have to destroy tanks and armored personnel carriers, rather you attack the oil supplies and allow them to run out of gas on the battlefield. Analysis from the Strategic Bombing Survey following World War II refuted the effectiveness of such a strategy. The report found that industrial targeting had little effect on Germany’s ability to wage war. What the report overlooks is that the theory itself may still be sound, after all the report also concluded that allied forces were unable to appreciably destroy those critical infrastructure targets. A prerequisite to judging the Industrial interdiction campaign in the 1940’s is the degree to which the targets were destroyed. PGM technology finally caught up with the theory. Operation ALLIED FORCE demonstrated that interdicting an adversary’s ability to wage war can exert pressure to capitulate, given that the critical targets can be effectively

destroyed. The lessons of World War II are only as valid as the precision technology available to the attacker.

Milosevic capitulated because NATO eventually identified his critical centers of weakness, namely the support of his own population, political elites and economic backers. Had NATO maintained a strategy of merely stopping the ethnic violence, Milosevic would have been better suited to waiting out the ineffective bombing campaign. The minimal suffering he endured from the diminishing of his armed forces in Kosovo would unlikely have pressured him to sue for peace. He demonstrated throughout the campaign his ability to resupply and reinforce Serb forces in Kosovo, despite NATO's efforts at destroying his military capabilities through direct attacks on troops, tanks and artillery. NATO essentially shifted from military "denial" strategy to one of "punishment" with the intent of weakening Milosevic's power base. It is one of the rare cases in the history of air campaigns where such a strategy has proved successful. Empirical research has highlighted the opposite case to be true, but one must remember that every war is different, every adversary motivated by different aims, and different coalitions possess varying levels of resolve.

Chapter 6

Conclusion

Since the dawn of military airpower in the early twentieth century, theorists have attempted to harness an alternative means to wage and win conflicts. The horrors of World War I and the tremendous casualties in that “war to end all wars” stimulated debate on how to apply emerging technologies to engage in war while reducing the human and material costs. Douhet (1932) argued that targeting civilian populations would destroy a target state’s will to fight; Mitchell (1922) argued that targeting a state’s industrial infrastructure would destroy its ability to wage the fight; the Air Corps Tactical School of the inter-war years (Meilinger, 2000) applied Mitchell’s theory in the Combined Bomber Offensive over Europe with little success; and Warden (1989) argued that targeting an adversary’s leadership would destroy its ability to fight. All sought to achieve victory with a focus on airpower, yet only when the technology caught up with the theories was the goal realized. Warden’s (1989) plan benefitted from technology where prior theories were left hamstrung by poor accuracy; namely, air forces now possessed the capability to deliver pin-point accurate aerial weapons anywhere in the world, stealth technology minimized detection of friendly air forces, and aerial-refueling and global-strike capable bombers mitigated the diplomatic constraints on over-seas basing.

Recent scholarship has evaluated many causal factors relating to decisions to go to war, domestic support once the war begins, and the duration of wars that end in success or failure. Some argue that opportunity and willingness of a state determines conflict initiation (Most and Starr, 1989; Fordham, 2004). Others posit that rational costs-

benefits analyses can tip the decision towards or away from war (Bueno de Mesquita, 1989); that military/civilian composition of governments affect war decisions (Betts, 1977; Vasquez, 1993; Gelpi and Fever, 2002); or that advanced military capabilities increase the propensity to opt for war (Ignatieff, 2000; Cohen, 1994). The results in this research validate many prior findings as PGM technology acts to mitigate the traditional costs of war, thus enabling the sanitized application of surgical airstrikes anywhere in the world. Collateral damage has been drastically minimized since the days of area bombing over Germany and Japan; the accuracy of laser- and GPS-guided munitions virtually assures the destruction of any target in just one mission; and the risk to the aircrews has reduced friendly losses from the tens-of-thousands in World War II to the tens or zeroes of the Gulf War (1991) or Kosovo (1999). The costs of war have been so reduced that aerial bombardment with manned-aircraft, cruise missiles, or drones has become an easy solution to a foreign policy crisis. Civilian leaders may be more tempted to use military force, where military veterans may still have a grasp of just how deadly war can be, at least to the recipients of an air campaign. The decision calculus has changed as lower risks place actual warfare far from the civilian populations' awareness (Ignatieff, 2000). Empirically measuring these arguments is a daunting task as they must accurately discern the decision-maker's mind, delve into the morality of warfare (a normative proposition) and just how connected constituencies are to the privations (or lack thereof), or have a precise picture of military capabilities or public opinion regarding a conflict. While the above issues are beyond the scope of this dissertation, the analysis of precision and conflict duration can at least provide a small glimpse into the efficacy of technology on successful (or failed) conflicts. Surgical air campaigns can actually lead to shorter

conflicts, thus tangentially validating previous findings. This analysis may provide a starting point for measuring willingness and opportunities, cost benefit analyses, or resolve amongst competing states.

This research asked whether PGM technology actually reduces the duration of aerial bombing campaigns. In a larger theoretical sense, it sought to explain how technology affects the decision-making of states when deciding whether or not to engage in an air campaign, how best to wage that campaign, and the additive effects of technology to power. The capabilities PGM technology provides act as a power-multiplier, as only relatively resolved states will opt into the conflict (Fearon, 1994). Weaker, unresolved states may opt out of the threatened conflict and concede to the more powerful state; the threat of a state with PGM capabilities is powerful enough to allow successful and peaceful coercion. The empirical results support the hypothesis that higher bombing-precision states tend to endure shorter campaigns. While accuracy was insignificant in Models 1 and 2, the post-1970 competing risks model (where PGM's were most prevalent) showed significance overall and in successful campaigns. In regards to duration, these results lend support to existing theories, namely Allen (2007), Horowitz and Reiter, (2001), Pape (1996), and Byman, Waxman, and Larsen (1999).

6.1 Empirical Findings

When all cases were analyzed without the competing risks model, the accuracy coefficient was positive but not significant; however, it became very significant after the competing risks model was run for both "all-cases" and "post-1970" cases. I conclude that the insignificance in the first model is due to the absence of PGM's prior to 1970.

The larger sample from 1917-2003 simply absorbs the effects of PGM weapons. While Allen (2007) found that air campaigns tend to be shorter when one of the parties is a democracy, the addition of the accuracy variable yielded some interesting results. 1) If the target state was a democracy, this factor contributed slightly less to terminating an air campaign but it increased in significance (p 0.10 to 0.05). 2) Pape's (1996) finding that vulnerability to denial shortens duration is bolstered here after adding accuracy. The coefficient increases and remains significant (p=0.05). This is consistent with the technological capabilities PGM's provide by assuring target destruction. The ability to precisely destroy the target state's ability to continue to wage war or negate its ability to counter-escalate (Byman, Waxman, and Larsen, 1999) is enhanced by this technology. Finally, 3) when other forces in addition to airpower are added, accuracy increases the duration of the campaign and becomes more significant (p 0.10 to 0.05). This lends support to the idea that when ground/naval forces are introduced the costs of war increase, thus increasing the resolve of the involved states and possibly lengthening the campaign. Model 1's results, however, do not support the hypothesis that precision reduces air campaigns. A more detailed competing-risks analysis is required to discern the effects PGM's have on air campaign duration.

In Model 2, accuracy was again insignificant, but if the attacking state was a democracy, both the coefficient and significance increased (p 0.1 to 0.001). Vulnerability to denial remained positive and increased in significance during successful campaigns, again highlighting the salience of the target's states reliance on conventional military forces or industrial infrastructure. The other-forces variable remained negative and increased in significance during failed campaigns, showing that increased resolve due to

the commitments of ground/naval forces tend to increase campaign duration when accounting for precision.

An analysis of the cases after 1970 showed the most significance of PGM's on air campaign duration. One would expect to see the most significance here as PGM's had first been introduced during the 1972 bombing of Vietnam. Accuracy affected campaign duration both overall as well as in the success model with a positive coefficient and a significance at the 0.001 level. Over all cases, if the target state was a democracy, duration *increased* and became significant ($p=0.001$), and conversely if the attacking state was a democracy, the duration *decreased* and was significant at the 0.001 level. Regime type had no effect when disaggregated in the success or failure models, which differs from the original Allen findings.

The empirical findings suggest that PGM's reduce duration of air campaigns in those cases where they were employed, yet the sample size ($N=24$) may be too small to generalize. Should comprehensive data on CEP and the proportional use of PGM's in all air campaigns become available, a more robust measure of precision could refine these estimates. Additionally, precision no longer resides in just aircraft, but armored tanks and naval vessels also apply various degrees of precision weaponry. Integrating precision measures into conflicts involving ground/naval forces could also refine these results. This is an area of future research into operationalizing the military capabilities of states into a more robust measure of individual state-power or power-distribution amongst states.

6.2 Case Studies

The case studies in this research highlight the importance of not generalizing too much regarding the empirical findings. Every conflict brings with it specific military, political, and social contexts. The overall conclusion of the case studies is that PGM's are only as effective as the strategy with which they are employed. The technology enables states to successfully destroy any target it deems necessary for ultimate victory; however, successfully destroying the wrong targets can contribute to defeat.

The Vietnam campaigns of Rolling Thunder and Linebacker I/II were different in two main aspects. First, Johnson waged the air war in Rolling Thunder using a strategy of gradual escalation without precision technology. The advice from his military leaders vacillated between attacking the industrial infrastructure of North Vietnam and the fielded Viet Cong insurgent forces operating in the South. The goal was to bring the Hanoi government to the negotiating table in order to broker a peace with the conditions of keeping South Vietnam a stable democracy and eliminating the insurgent guerilla forces. His fear of inadvertently involving the Chinese or Soviets prevented the intense bombing of Hanoi industry, especially the port facilities at Haiphong. One issue with this strategy was that North Vietnam did not possess a critical industrial infrastructure to attack, and the main threat to South Vietnam, the Viet Cong, did not rely on large quantities of logistics to sustain their operations. Even had PGM's been available, Johnson was using a conventional air strategy against an unconventional force. The effectiveness that precision brought to U.S. capabilities would have been mitigated by the North Vietnamese government simply finding ways to replace the infrastructure they lost and to smuggle in small quantities of arms and food to the guerilla forces.

Secondly, Johnson was facing increased political opposition to the war from the American public at home. The Vietnam War was one of the first conflicts to be televised and reported in near real-time, thus bringing the horrors of war home to the American public. As opposition to casualties increased, coupled with a poor articulation of national interests in the region, Johnson lost the domestic commitment required to intensify the air campaign. The U.S. was also in the midst of a domestic upheaval in race relations and social issues, so Johnson's ability to intensify an already unpopular war was severely curtailed.

By the time Nixon assumed the U.S. presidency several aspects of the war in Vietnam had changed. The American public wanted an exit strategy from the conflict, and Nixon obliged with the policy of turning over the defense of South Vietnam to its own inhabitants. "Vietnamization," as the policy was called, began the removal of ground troops and air forces. As Hanoi saw the withdrawal building, they eventually launched a conventional invasion of South Vietnam in 1972 with the goal unifying both halves of the country. Nixon's response was swift, overwhelming, and precise. The first PGM munitions had become available in large numbers, and Nixon used them to great effect in an intense bombing campaign of both military forces and infrastructure. In contrast to Johnson, the conventional operation launched by Hanoi now became vulnerable to airpower, and Nixon had the precise weapons available to destroy not only the armed forces, but their supply trains as well. Nixon applied the right tool at the right time and succeeded in bringing Hanoi back to negotiate a peace settlement.

The Vietnam air campaigns represented the value of marrying the right strategy with the right weaponry. In these cases, the latter campaign only lasted approximately six

months and succeeded in its objectives, versus three years of prior bombing failures. PGM's would likely not have altered the course of Rolling Thunder, and it is instructive to use this case to evaluate the potential limitations of future air campaigns. Many of the lessons of Vietnam were applied to the Gulf War (1991), and that war was so successful mostly due to the air campaign preparing the battlefield for eventual ground troops. PGM's were married with stealth technology to fight a conventional war in an overwhelming and intense bombing campaign. Gradual escalation was abandoned in favor of a "shock and awe" type campaign. Indicative of the anti-Vietnam strategy mindset, the Gulf War campaign was named *Instant Thunder* (as opposed to Rolling), a direct refutation of the strategies followed during Vietnam.

By 1999, the lessons of Vietnam had been forgotten as the U.S. and its NATO allies waged an air campaign against Serbia over the small province of Kosovo. This conflict was unique in two characteristics: 1) PGM usage had increased 4-fold since Vietnam, but it lasted longer than Linebacker II and Instant Thunder combined; also 2) it employed another gradually escalating campaign. The Clinton administration attempted to halt the ethnic cleansing of the Kosovar Albanian population through a gradual air campaign to increasingly apply pressure on Milosevic. Complicating this strategy was the 19-member NATO alliance which was involved in the strategic targeting and decision making of the campaign. The consensus required to rapidly shift targeting strategies curtailed the flexibility of the air forces to respond to emerging threats. Additionally, the U.S. made public that it would not introduce ground troops, this war would be fought by airpower alone. This strategy allowed Milosevic to disperse and hide his military forces in mountainous terrain that provided exceptional concealment. The precision capabilities

of PGM's were rendered ineffective, as targets were unable to be located and destroyed fast enough to prevent their use to slaughter Albanians. This strategy resembled the Johnson strategy of 1965-1968; attempting to destroy the equipment and supplies of dispersed forces operating in small numbers amongst a civilian populations. Precision may have reduced the collateral damage reminiscent of Vietnam, but it was ineffective at halting the ethnic cleansing.

The tide turned to success once NATO shifted its strategy to destroying Milosevic's political support. An intense bombing campaign began after it became apparent that the gradual escalation was failing. The focus shifted to destroying Serbia's industrial infrastructure and economy, the main well-spring for the oligarchic financial and political backers of the regime. Here, the advantages of PGM's can be fully realized as identifiable and critical targets can be successfully identified and destroyed. Once this support eroded, Milosevic would have faced the three typical outcomes for a deposed dictator: exile, imprisonment or death. He chose to concede, as scholars believe, with the hope of retaining power and negotiating a settlement. Had he held out longer than he did, he may have not had this opportunity.

The Kosovo air campaign was an example of an air campaign that began by applying the wrong strategy to the political crisis. Fortunately, it was corrected early enough to intensify the bombing, identify the critical targets, and maintain support of NATO and its member-states' constituencies. PGM's contributed to destroying every target assigned to them, but the shortcoming rested on an ineffective strategy against ineffective targets.

6.3 Future Research Directions

PGM's seem to have provided a way to quickly and cheaply wage and win conflicts with adversaries, but these weapons also provide challenges to policy-makers as well as military leaders; constituent support, costs in lives and material, identifying the correct strategy to maximize capabilities, and the international responses that either help or hinder coercive objectives. While this research proved significant and added to the overall literature on air campaign duration and measurement of state power, the accuracy needs to be further refined to capture the true military capabilities of states that possess them. Capturing the proportional impact of PGM's, for example, in conjunction with older-generation "dumb-bombs" can help get a sense of the preponderance of their effects.

Secondly, the case studies highlighted an aspect of air campaigns that I had not considered when beginning the study: campaign intensity. Both Vietnam and Kosovo lacked intensity in some aspects of their execution, and a means by which to measure this factor should be developed. Data exists on the numbers of sorties per day, tonnage of bombs dropped, and the types of targets attacked, but operationalizing this variable could better gauge the effectiveness of precision via intensity. Another challenge would be to assemble data from non-western states that may not keep accurate or openly-accessible figures on their past air campaigns.

Finally, from a qualitative approach, there is a unique moral aspect to waging surgically-precise air campaigns that could have an impact on public support for decision makers. An analysis of public attitudes towards air campaigns over time could shed light on how the general population supports or rejects the use of air power. Since democracies

are beholden to constituencies, do leaders decide to employ force even in the face of domestic opposition? Do domestic forces support air operations for only certain types of crises, such as humanitarian, genocidal, etc.? Does support change when the air campaign is conducted by unmanned drones or with the purpose to oust a regime or rebuild a state? With manned aircraft, at least there is some risk to those waging the conflict, as opposed to drone strikes where no pilot is under threat of the same destruction being rained down upon the adversary. There appears to be a consensus of assumption in political science literature that Americans are casualty-averse, but do these attitudes only apply to ground troop casualties, airmen or both?

In Virtual War, Michael Ignatieff (2000) argues that the increased lethality, precision, and survivability of aerial warfare removes the public from the horrors and impact of war, so much so that they typically provide their virtual consent to political leaders to employ air power as an expedient in any given crisis. This dissertation argues that PGM's reduce casualties in the attacking state's forces, thus mitigating the lethality and public backlash associated with warfare by democracies. I believe the data support this claim, but there is a larger question, does it matter? Since the War Powers Act (an act that sought to limit executive war-making), the use of Presidentially-directed military operations appear prolific. Grenada (1983), Libya (1986, 2011) Honduras (1980's), Panama (1989), Gulf War (1991), Somalia (1993), Haiti (1994), Bosnia-Herzegovina (1995), Kosovo (1999), Afghanistan (2001), Iraq (2003), and drone strikes throughout the Middle East and Africa (present) are all examples of U.S. conflicts where a declaration of war was never issued by Congress. In addition, no president standing for re-election has

ever been voted out of office or impeached for initiating a conflict without a Congressional declaration of war.

Scholars have produced prolific literature on constituent support for decision-making in democracies, but there appears to be less on political accountability from the constituents once the decision for war has been made. Specifically, how do constituencies in democracies respond to air campaigns once they begin, and are the perceived threats of casualty-averseness associated with air campaigns valid? “Gun-boat” diplomacy has been steadily supplanted by “drone-float” diplomacy, and I am interested in international attitudes regarding this newest form of airpower. With drone aircraft so closely linked to satellite surveillance, I would expect an increasing negative attitude toward both; not because the technology is too lethal to enemies, but because it is so easily adaptable for domestic purposes.

References

- Allen, Susan Hannah. 2007. Time Bombs: Estimating the Duration of Coercive Bombing Campaigns. *Journal of Conflict Resolution* 51 (1): 112-33.
- Babington, Charles and Helen Dewar. "Clinton Pleads for Support," *Washington Post*, 24 March, 1999.
<http://www.washingtonpost.com/wp-srv/national/daily/march99/clinton24.htm>
- Bennett, Scott D., and Alan C. Stam III. 1998. "The Declining Advantages of Democracy: A Combined Model of War Outcomes and Duration." *Journal of Conflict Resolution* 42 (June): 344-66.
- Betts, Richard K. 1977. *Soldiers, statesmen, and cold war crises*. Cambridge, MA: Harvard University Press.
- Biddle, Stephen, and Stephen Long. Democracy and Military Effectiveness: A Deeper Look. *Journal of Conflict Resolution* August 2004 vol. 48 no. 4 525-546
- Boehmke, Frederick J. 2005. DURSEL: A Program for Duration Models with Sample Selection (Stata version). Version 2.0. Iowa City, IA: University of Iowa.
<http://myweb.uiowa.edu/fboehmke/methods>.
- Boehmke, Frederick J., Daniel Morey and Meghan Shannon. 2006. "Selection Bias and Continuous-Time Duration Models: Consequences and a Proposed Solution." *American Journal of Political Science* 50 (1): 192-207.
- Bueno de Mesquita, Bruce. 1989. The contribution of expected utility theory to the study of international conflict. *The Handbook of War Studies*, ed., 143-69. Ann Arbor: University of Michigan Press.
- Byman, Daniel, and Matthew Waxman. *The Dynamics of Coercion*. 2002. Cambridge University Press: Cambridge, U.K. 281pp.
- Byman, Daniel L., Matthew C. Waxman, and Eric Larson. 1999. *Air Power as a Coercive Instrument*. RAND Publications, Washington D.C.
- Cederman, Lars-Erik. 2003. Modeling the size of wars: From billiard balls to sand piles. *American Political Science Review* 97 (1): 135-50
- Clausewitz, Carl Von. *On War*. 1832. Michael Howard and Peter Paret, ed. 1976. University of Princeton, NJ.
- Clodfelter, Mark. *The Limits of Airpower: The American Bombing of North Vietnam*. 1989. University of Nebraska Press: Lincoln, NE. 311pp.
- Cohen, Eliot A., *The Mystique of U.S. Airpower*. *Foreign Affairs* 73(1): 109-24.

- Correll, John T. "Assumptions Fall in Kosovo," *Air Force Magazine*, June, 1999.
- Corum, Delbert, Colonel USAF (et. al) in *Air War Vietnam*. 1978. Arno Press: New York, NY.
- Department of Defense, U.S. "Report to Congress: Kosovo/Operation Allied Force, After-Action Report," 31 January, 2000.
<http://www.dod.mil/pubs/kaar02072000.pdf>
- Douhet, Giulio. *The Command of the Air*. 2009. University of Alabama Press. Tuscaloosa, AL.
- Dugdale-Pointon, T. (3 May 2008), *Concept; CEP Circular Error Probability*,
http://www.historyofwar.org/articles/concepts_circular_error_probability.html
- Erlanger, Steven. "Economists Find Bombing Cuts Yugoslavia's Production in Half," *New York Times*, April 30, 1999.
<https://www.nytimes.com/learning/students/pop/articles/043099kosovo-serbia.html>
- Fearon, James D. 1994. Signaling versus the balance of power and interests: An empirical test of a crisis bargaining model. *Journal of Conflict Resolution* 38 (2): 236-69.
- Fordham, Benjamin O. *A Very Sharp Sword: The Influence of Military Capabilities on American Decisions to Use Force*. 2004. *Journal of Conflict Resolution* 48 (5): 632-656.
- Gartner and Siverson 1996; Gartner, Scott Sigmund, and Randolph M. Siverson. 1996. War expansion and war outcome. *Journal of Conflict Resolution* 40 (1): 4-15.
- Gelpi, Christopher, and Peter D. Feaver. 2002. Speak softly and carry a big stick? Veterans in the political elite and the American use of force. *American Political Science Review* 96 (4): 779-93.
- Gillespie, Paul G. *Weapons of Choice: The Development of Precision Guided Munitions*. 2006. University of Alabama Press: Tuscaloosa, AL.
- Gilpin, Robert. 1981. *War and change in world politics*. New York: Cambridge University Press.
- Gordon A., and Alexander L. George. 1995. *Force and statecraft*. 3rd ed. New York: Oxford University Press.
- Graham, Bradley and William Drozdiak. "Allied Action Fails to Stop Serb Brutality,"

- Washington Post*, March 31, 1999.
<http://www.washingtonpost.com/wp-srv/inatl/longterm/balkans/stories/military033199.htm>
- Hallion, Richard P. *Precision Guided Munitions and the New Era of Warfare*. 1995. Air Power Studies Center, RAAF Fairbairn, Australia.
<http://www.fas.org/man/dod-101/sys/smart/docs/paper53.htm>
- Headrick, Daniel M. 1981. *The tools of empire*. New York: Oxford University Press.
- Horowitz, Michael, and Dan Reiter. "When Does Aerial Bombing Work?: Quantitative Empirical Tests, 1917-1999. *The Journal of Conflict Resolution*, 2001. Vol 45 (2) 147-173.
- Hosmer, Stephen T. *The Conflict Over Kosovo: Why Milosevic Decided to Settle When He Did*. 2001. Project Air Force: RAND. Santa Monica: CA.
- Huntington, Samuel P. *The Clash of Civilizations: Remaking of World Order*. 1996. Simon & Schuster: New York, NY.
- Ignatieff, Michael. "To Fight but Not to Die." *The World Today*, Vol. 56, No. 2 (Feb., 2000), pp. 20-22.
- Ignatieff, Michael. *Virtual War*. 2000. New York: Henry Holt and Company.
- James, Patrick and John R. O'Neal. *The Influence of Domestic and International Politics on the President's Use of Force*. *The Journal of Conflict Resolution*, Vol. 35, No. 2, Democracy and Foreign Policy: Community and Constraint (Jun., 1991), pp. 307-332
- Karnow, Stanley. *Vietnam: A History, The First Complete Account of the Vietnam War*. Viking Press: New York, NY. 1983.
- Keohane, R. and Joseph Nye. 2001. *Power and Interdependence*. New York: Longman.
- Lake, David A. 1992. "Powerful Pacifists: Democratic States and War." *American Political Science Review* 86 (March) 24-37.
- Lambeth, Benjamin S. *The Transformation of American Airpower*. Cornell University Press. 2000.
- Lambeth, Benjamin S. *NATO's Air War for Kosovo: A Strategic and Operational Assessment*. 2001. Project Air Force: RAND. Santa Monica: CA.
- Leonard, Raymond W. *Learning from History: Linebacker II and U.S. Air Force Doctrine*. *The Journal of Military History*. 58 (April 1994) 267-303.
- Maoz, Zeev, and Nazrin Abdolali. 1989. "Regime Types and International Conflict,

- 1816-1976.” *Journal of Conflict Resolution* 33 (March): 3-36.
- Mearsheimer, John J. 2001. *The tragedy of great power politics*. New York: Norton
- Meilinger, Phillip S. A History of Effects Based Air Operations. *The Journal of Military History*, Vol 71, (Jan 2007), pp. 139-68.
- Milosevic, Slobodan. St. Vitus Day Speech. 28 June, 1989.
http://cmes.arizona.edu/sites/cmes.arizona.edu/files/SLOBODAN%20MILOSEVIC_speech_6_28_89.pdf
- Mitchell, William. *Winged Defense: The Development and Possibilities of Modern Airpower-Economic and Military*. 1925. G.P. Putnam’s Sons: New York, NY.
- Morgan, T. Clifton, and Sally Campbell. 1991. Domestic structure, decisional constraints and war: So why Kant democracies fight? *Journal of Conflict Resolution* 35: 187-211.
- Morgenthau, Hans. 1948. *Politics Among Nations: The Struggle for Power and Peace*. New York: McGraw Hill.
- Most, Benjamin A., and Harvey Starr. 1989. *Inquiry, logic and international politics*. Columbia: University of South Carolina Press
- Nye, Joseph S. 2004. *Soft Power: The Means to Success in World Politics*. Public Affairs.
- Nye, Joseph S., and William A. Owens. America's Information Edge. *Foreign Affairs*, Vol. 75, No. 2 (Mar. - Apr., 1996), pp. 20-36
- Overy, R. J. *The Air War: 1939-1945*. 1991. Scarborough House Publishers: Chelsea, MI.
- Paarlberg, Robert L. Knowledge as Power: Science, Military Dominance, and U.S. Security. *International Security*, Vol. 29, No. 1 (Summer 2004), pp. 122–151
- Pape, Robert A., Coercive Airpower in Vietnam. 1990. *International Security* 15 (2):103-46.
- Pape, Robert A., *Bombing to Win: Air Power and Coercion in War*. 1996. Cornell University Press: Ithaca, NY. 366pp.
- Rasler and Thompson 1999 Rasler, Karen, and William R. Thompson. 1999. Predatory initiators and changing landscapes for warfare. *Journal of Conflict Resolution* 43 (4): 411-33.
- Reiter, Dan, and Allan C. Stam III. 2002. *Democracies at war*. Princeton, NJ: Princeton

University Press.

Reiter, Dan, and Alan C. Stam III. 1998. "Democracy, War Initiation, and Victory." *American Political Science Review* 92 (June): 377-89.

Reiter Dan, and Alan C. Stam III. 1998a. "Democracy and Battlefield Military Effectiveness." *Journal of Conflict Resolution*. 42:3 259-277.

Schelling, Thomas C. *Arms and Influence*. 1966. Yale University Press: New Haven, CT. 293pp.

Schultz, Kenneth. 1998. Domestic opposition and signaling in international crises. *American Political Science Review* 92 (4): 829-44.

Summers, Harry G. *On Strategy: A Critical Analysis of the Vietnam War*. 1982. Presidio Press: Novato, CA.

United Nations Security Council Resolution 1244. 10 June 1999.
<http://www.nato.int/kosovo/docu/u990610a.htm>

Vasquez, John A. 1993. *The war puzzle*. Cambridge: Cambridge University Press. 214

Warden, John A. Col USAF. *The Air Campaign: Planning for Combat*. Pergamon-Brassey Publishing: Washington D.C. 1989.

Waltz, Kenneth. 1979. *Theory of International Politics*. Long Grove: Waveland Press.

Wolfers, Arnold. 1962. *Discord and Collaboration: Essays on International Politics*. Baltimore: Johns Hopkins University Press.